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Aeronautical Engineering
Edited by - - THURSTAN JAMES

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WORKING FOR THE FUTURE

THE general air of confusion hanging over aeronautical affairs in these islands was exemplified last week. Soon after the contract was signed between B.O.A.C. and Vickers, people were remarking to each other, "So B.E.A. placed the order with Vickers after all," or, "So Vickers got the order (from B.E.A.) after all." People more in touch with realities were asking how it was that B.O.A.C. could place an order for £60 million with Vickers whereas there was utter chaos when B.E.A. tried to place one for £25 million with the de Havilland Company. The answer is, of course, that arrangements between B.O.A.C. and Vickers had been agreed before publication of the Government's new ordering policy had been made.

Although for the third week in succession the outcome of the attempt by B.E.A. to place an order for the aeroplane it needs with the firm of its choice is still awaited, an irrevocable change has come over the structure of the British aircraft industry. A sales mission has been dispatched to the United States under the joint ægis of the Hawker Siddeley Group and the Bristol Aeroplane Company. The fact that the team consists solely of technicians for the Bristol Aircraft Company cannot alter the first significant fact. To the design and production teams of the Hawker Siddeley Group must now be added those of Bristols and Shorts. It also means that the companies owning two of the biggest engine constructing plants, after Rolls-Royce, have taken joint action.

When the turmoil around the placing of the B.E.A. order first became apparent we drew attention to the danger of throwing away the baby with the bath water, and took pains to explain that the baby was nothing less than Britain's opportunity to sell increasing values of air transport aircraft in the market of the World. Last week we drew attention to the statements made by the president of the S.B.A.C., Mr. Cyril Uwins, O.B.E., A.F.C., who called for a stiffened resolve to see our civil aircraft working wherever aircraft fly and for the ultimate expansion of our resources.

Nobody can pretend that the selection of one company by B.E.A. and the attempt by another group to obtain orders in the United States for an almost similar aircraft is going to work to the common good. Whereas a combination of orders could certainly make the venture profitable, the undertaking by separate concerns to meet separate orders would duplicate the entire production effort. It seems, then, that all such Government scheming as there has been has achieved no more than to land things into their present mess.

So far as we are aware no official pronouncement has ever been made of any Government plans for the industry. It is often assumed that certain plans do exist and indeed are on occasion referred to by the name of those who are alleged to have drawn them up. No doubt various geographical rearrangements of the industry were drawn up as studies and to provide a basis for discussion rather than as a plan for action. Indeed if the Government did have a plan, assuming that any foresight was exercised at all, it must have been clear from the start that B.E.A. should have been advised of approved regrouping arrangements before it came to make its decision. Then the present futility of holding meeting after meeting to find some way out of the impasse would never have arisen.

Military aircraft are in the doldrums but nobody of experience expects that situation to last. We are going to want more manned aircraft and we are going to want military transports. But until the Ministry of Defence comes around to this point of view there won't be any orders. Meantime, there are glittering prizes in the export market for those who can develop and sell air transports of all speeds, including those with VTOL capability and those which one day will fly faster than sound. Yet if military orders fade and cease, so will the expenditure on research effort.

The continuance of civil research effort must be planned. The Air Planning Authority must be free of the ebb and flow of political tides. We have a wonderful treasure of aeronautical knowhow and experience. Those who have the good of the country at heart must work to see it flourish and expand.

And this precious treasure, which has been gathered and hoarded over 50 years of effort, does not solely consist of the well-integrated design and manufacturing teams in the aircraft factories, it consists of devoted men in Government research establishments and laboratories. It comprises as well research units in numerous Universities. By the efforts of all these people, it is, that we have succeeded in getting our heads above the waves of international competition.

At the present time military demand in this country has moved from aircraft to missiles. If missiles are to be successful much research work will need to go on. Some of it will be useful in the development of manned aeroplanes for sale overseas. Much that is needed to maintain supremacy in aircraft manufacture will not go on if the military pressure is not there. That is where the Air Planning Authority would come in with a 10-year programme of development.

MATTERS OF MOMENT

Fighter Command's Future

SPEAKING last week after the transfer ceremony of No. 41 Squadron at Biggin Hill, which is described on pages 110-111 of this issue, the C.-in-C. Fighter Command, Air Chief Marshal Sir Thomas Pike, revealed that the first Bristol Bloodhound surface-to-air missiles are expected at North Coates, Lincolnshire, within the next two months. These would be only the first of a series, and what Air Chief Marshal Pike referred to as the "Mks. II and III" Bloodhound would follow fairly closely. They would apparently be particularly effective in intercepting low-altitude targets, as would the English Electric Thunderbird, which will be operated both by Fighter Command and the Army in the field.

These are very effective weapons, but the manned fighter would be retained for two reasons. The first was for operations against aircraft which might attempt photographic-reconnaissance sorties over the U.K. In peace-time it was not desirable to launch missiles against unidentified aircraft, but fighters could be sent up to make visual inspections and take appropriate action. In its second rôle, the manned fighter, represented ultimately by the English Electric P.1, would operate several hundred miles from the coast, leaving an inner ring of missiles for short-range defence.

Fighter Command, in the words of the C.-in-C., therefore had an indefinite life before it, and the P.1 would have a "big future" for something like 10 years. Fighter stations in Eastern England were having their runways extended from 2,000 to 2,500 yd. to operate the P.1, and those which could not be extended, or were not facing the main threat from the East, were being closed. The number of fighter squadrons was being progressively reduced, starting with units having earlier marks of Hawker Hunters, but no Hunter 6 squadrons would be phased out for some time. The main aircraft strength of Fighter Command would then be the Gloster Javelin, until this was replaced in turn by the P.1.

Towards the VTOL Airliner

A SPECIAL significance attaches to the publication in this issue of THE AEROPLANE of extensive extracts from a specification drawn up by the engineering staff of B.E.A. for a VTOL aeroplane. This is the first time, of which we are aware, that an airline has set out what its requirements would be if the decision were taken to acquire vertical take-off aircraft. It can be argued, of course, that a compound aircraft such as the Fairey Rotodyne comes into this category, other people will argue that the true VTOL aircraft will use directly generated thrust from gas turbines. Such thrust would be obtained either by deflecting the efflux from the main engines or, as is more likely, by using the combined thrust from a battery of smaller and specially installed engines. In this field Great Britain is generally assumed to have the lead with the Rolls-Royce R.B. 108 units.

Our extracts from the B.E.A. specification gain in interest when read in conjunction with our report of the lecture given to the Leicester branch of the Royal Aeronautical Society.

In reply to a question Mr. Lombard confirmed that fuel reserves for the landing of a jet-lift airliner were indeed important but were reduced considerably (in relation to diversionary requirements for conventional aircraft) by the ability of VTOL aircraft to land in a smaller space. During the slow descent, height would be measured accurately by a radio altimeter.

We have heard it said that the development of VTOL aircraft must be carried through as a military development, for its first stage. Clearly, any military arm that could develop a VTOL transport and failed to take the chance would be culpable of putting its head in the sand to a suicidal extent. On the other hand, once an airline with the operating experience of B.E.A. sets out its requirements, it is a challenge to designers and planners alike to see what can be done to meet the specification.

There has never been any doubt that the advent of air transports with VTOL capability will change the entire pattern of aerodrome construction but what is often overlooked is that the power to make a controlled vertical descent at a slow rate will alter air traffic control requirements not only so far as "hold-offs" and stacking are concerned but also as Mr. Lombard pointed out from the point of view of carrying extra fuel for diversion in bad weather.

An Atomic Princess?

IN view of the present situation on the Isle of Wight, our understanding that the U.S. Navy is interested in using the three Saunders-Roe Princess flying-boats as test-beds for atomic reactors is most welcome. Everyone would be delighted to see the Sleeping Beauties awakened at last.

One seemingly logical solution would be for the original layout of four contra-props and two single-rotation propellers to be replaced by six single-rotation propellers driven by steam-powered free turbines. This would involve a minimum of re-design work although the fuselage would require a considerable amount of attention for installation of reactor and shielding.

Another possibility that has been examined for using the Princesses would be the installation of six Rolls-Royce Tyne turboprop engines. By the time the re-design was completed in, say, a year from now, there might well be enough Tynes available to re-engine at least one Princess. This would serve the double purpose of putting in many flying hours with the new engine and giving these flying-boats gainful employment in Transport Command of the R.A.F.

ALMOST OFF.—The Avro Aircraft CF-105 Arrow gathers speed during its first taxi-ing trials. It is powered by two Pratt & Whitney J75 turbojets. Another picture of Canada's newest fighter is on page 119.

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FULLY ANGLED.—Commissioned on January 14, H.M.S. "Victorious" is the first R.N. carrier to be fitted with the fully angled flight deck of 8½°. Described in THE AEROPLANE of January 10, the "Victorious" is expected to start her sea trials next month.

Photograph copyright "The Aeroplane"

Missile Research in Canada

IN the annual report of the Canadian Defence Research Board, recently published in Ottawa, it is recorded that there was a shift of emphasis in the 1957 programme from research leading to direct development to fundamental investigations. These newly aligned studies, the report says, were directed towards support of U.K. and U.S. ballistic missile defence activities and expanded weapons-system and defence-system evaluations.

"Working closely with scientists from the other two countries," it goes on, "DRB staff members increased and accelerated scientific effort related to the development of a defence against intercontinental ballistic missiles (ICBMs). The programme involves studies of a scale-model ICBM passing through a simulated atmosphere, research in upper atmospheric physics, infra-red detection and guidance, and the development of new propellents for large rockets.

"To assist in obtaining vital scientific information about the upper atmosphere, the Board and the United States Air Force are beginning construction of a large radar installation near Prince Albert. Aimed at studying the aurora borealis (northern lights) and its likely effects upon ICBM detection, the joint project will begin this summer. Staff members of the University of Saskatchewan's Institute of Upper Atmospheric Physics will collaborate with the defence scientists."

Another DRB activity during 1957 mentioned in the report is work by their operational research scientists, associated with the problem of defence against missile-armed long-range submarines.

Monorail to the Airport

EVIDENCE of deepening official interest in the monorail system of transport is to be found in the visit to Cologne last week of Mr. G. R. H. Nugent, Parliamentary Secretary to the M.T.C.A. The purpose of Mr. Nugent's visit was to inspect the trial length of Alweg monorail in that city, with a view to forming some idea of the practicability of using this form of transport for a link between the centre of London and London Airport. Mr. Nugent was accompanied by officials of his own Ministry, a representative of the British Transport Commission and Sir Alfred Bossom, M.P., described as "chairman of an executive group set up to study this form of transport." We understand that a company called Air-Rail, Ltd., has been formed to exploit the Alweg system in Britain, and that Tube Investments, John Mowlem, Portland Cement and Travers Morgan are among the companies interested.

Construction of a monorail link has been suggested as a possible solution to the problem of reducing the journey time while at the same time providing for the anticipated increase in the number of passengers. Methods of providing direct rail connection have already been studied by a working party set up by the M.T.C.A., the B.T.C., B.E.A. and B.O.A.C. in 1956, and this committee proposed construction of a new overground line from Victoria to London Airport Central. This proposal had some attractive features, including a non-stop journey time of 22 minutes, which is about half the present coach time from the West London Air Terminal to the central area. Although the coach time should be reduced when the Cromwell Road extension is completed and, later, the South Wales radial road is built, it must be clear to all concerned that coaches will never be able to cope with traffic rates of 6,000 passengers an hour—which is the expected peak at London Airport in 1970.

Consideration of the monorail idea was excluded from the terms of reference of the Working Party, but this did not necessarily indicate any prejudice on the part of the Minister. One of the major difficulties with the overground link from Victoria is the need to tunnel from the airport boundary to the central area, and this might be an even greater problem in the case of the monorail. But any solution which stops short of the central area is certainly not going to be acceptable, more especially as it now seems that the Millbourn Committee recommendations for further development of the island site are likely to be accepted.

Another drawback with the monorail is that it is comparatively unproved. As the official statement last week said: "Before a system of this kind could be brought into public use in this country, long and rigorous tests would have to be conducted over a trial length, to satisfy the exacting safety requirements of the M.T.C.A." We cannot afford, in this matter, to embark on an extensive series of tests if they only delay still further the day when adequate facilities are available to convey passengers to and from the airport. The suggested surface rail link from Victoria, although perhaps more expensive than the Alweg monorail, would not interfere seriously with existing communications; but a delay of, say, two years in starting while other possibilities are studied may mean that the opportunity is lost for ever.

Alleged Aircraft Theft

CHARGES of fraudulent conversion in connection with the sale and purchase of civil aircraft and of stealing aeroplanes were made at Guildhall, before Alderman Sir Cuthbert Ackroyd, against Henry Turner Armstrong, 42, a "dealer" with an address in Belgium. It was stated by Chief Detective Inspector Lea that the police had been looking for the accused for 12 months, but had been unable to execute a search warrant. Recently, however, he had flown to Rochford in order to "pick up" an aircraft which had been repaired, and which he intended to fly back to Belgium. He was detained by the local police.

Mr. F. H. R. Burr, counsel representing the Director of Public Prosecutions, detailed charges upon which he asked that the accused should be committed for trial. They were: That in February, 1955, Armstrong having been entrusted in the City of London with a cheque for £150 for payment to the Wiltshire School of Flying, Ltd., he applied that sum—earmarked for payment in respect of repairs to aircraft—to his own use and benefit. Counsel said it was alleged that Armstrong had dealt with other cheques, handed to him to pay for repairs, in a similar manner. He was further charged with stealing two aircraft valued together at £120, and a Tiger Moth worth £60. Ostensibly acting in the interests of the Wiltshire School of Flying the accused was said to have paid cheques he received from that institution into his own bank.

The accused, upon committal for trial at the Old Bailey, was detained in custody.

PIONEERS' PARTY.—At Issy-les-Moulineaux on January 13 celebrating the 50th anniversary of the first flight in a closed circuit (by Farman in a Voisin) were, left to right: Henry Farman, M. Christiaens, Secretary for Air, and Gabriel Voisin. Below, left, an Alouette helicopter which flew round the historic circuit, above the veteran Voisin biplane.

Commemorating a Record

THERE was a large gathering on what was once the Parisian aerodrome, and is now the heliport, of Issy-les-Moulineaux close by the Seine and the Eiffel Tower on January 13 last when the anniversary of Henry Farman's record-breaking flight of 50 years earlier was celebrated. This, as we recorded last week, consisted of flying a circuit of one kilometre in 1 min. 28 sec. The aeroplane was a Voisin biplane and the engine, designed by Levavasseur was a 50 c.v. Antoinette.

The three principal characters concerned, MM. Henry Farman, Gabriel Voisin and Kapfrer, the official time-keeper of the Aéro-Club of France who timed the record, were there. Although a Voisin biplane similar to the record-breaker had been built under the care of Charles Dolfus, no attempt was made to fly it round the course during the commemoration ceremony, but an Alouette helicopter with Voisin on board flew the course followed on the ground by an old Renault automobile in which was the president of the Aéro-Club of France.

The band of the French Air Force supplied martial music during the various ceremonies, and speeches were made by the president of the Aéro-Club of France and the Secretary of State for Air, M. Christiaens, in front of the statue erected at the entrance to the present helicopter port of Issy to commemorate Farman's flight.

Nowadays, when speeds of 2,000 km.p.h. are becoming frequent, it is almost impossible to realize how much more difficult it was 50 years ago to fly one kilometre in an aeroplane of the day and at a speed of 48 km.p.h. with only 50 h.p. to keep one in the air and give the necessary directional control. This flight by Farman was remarkable primarily because it was the first directionally controlled flight of a heavier-than-air craft. Previous to Farman's kilometre record he had made a record flight of 770 metres at Issy on October 26, 1907, also in a Voisin biplane. Santos Dumont, in his Santos Dumont 14bis with an Antoinette engine, had made the first aeroplane record for a flight of 220 metres at Bagatelle, France, on November 12, 1906. However, these earlier records were in a straight line.

Following the ceremony at Issy there was an official reception at the town hall of Issy where an historical exhibition of aviation interest was formally opened. In the evening at the Aéro-Club de France there was an official banquet attended by 300 people, among whom were again Farman, Voisin and Kapfrer. With them were many other pioneer pilots, men and women, who had all played their part in the early days of aviation, not only in France but in other countries.

Great Britain was represented by Lord Brabazon of Tara, Sir Frederick Handley Page, Mr. Claude Grahame-White and Captain K. J. G. Bartlett. Mr. H. R. Gillman from the F.A.I., the international organization which has registered all aviation records from the start to the present day, was also present.

Speeches were made by Gabriel Voisin, Lord Brabazon of Tara, M. Christiaens who, at the end of his speech, and amidst tremendous applause, announced that he had asked that the Order of Grand Officer of the Legion of Honour be bestowed on Henry Farman and Gabriel Voisin. "A.N."

Celebrating a Global Circuit

TO mark the arrival in London of the first round-the-World commercial air service to operate through the United States —a service inaugurated from Melbourne on January 14 by Australia's international airline, Qantas Empire Airways—the Deputy High Commissioner for Australia, Sir Edwin McCarthy, held a reception at Australia House on January 17.

Sir Edwin, who was assisted by the Commonwealth's Civil Aviation Liaison Officer, Mr. W. G. Burns and other senior Australian officials, received as guests of honour, five members of an official party who had arrived that day from Washington, having flown across the Atlantic as the guests of Qantas. Two of the party were senior officials of the United States Department of State—Mr. Laurence Vass, Director of Transport and Communications, and Mr. Francis Jarvis, Officer-in-Charge of Economic Affairs in the Office of South West Pacific Affairs—and two officers of the United States Civil Aeronautics Board —Mr. Jacob W. Rosenthal (Chief of the Carrier Relations Division) and Mr. Roy E. Foulkes (assistant to Board member Mr. Louis J. Hector). The fifth member of the party was Mr. Ray Maley, Press Attaché, representing the Australian Embassy in Washington.

Among the principal guests, who included representatives of the major airlines, were four members of the United States Embassy in London—Mr. Edward M. Martin, Minister for Economic Affairs, Mr. Martin M. Tank, Counsellor for Economic Affairs, Mr. James W. Swihart, First Secretary, and Mr. Thomas J. Carter, Civil Air Attaché. Mr. H. A. A. Hankey, Foreign Office Counsellor, and Mr. Livingstone Satterthwaite, of the State Department, who led the American delegation which negotiated the recent United States-Australia Air Agreement, were other notable guests.

Representatives of the United Kingdom Ministry of Transport and Civil Aviation included Sir Gilmour Jenkins (Permanent Secretary), Mr. A. H. Wilson (Deputy Secretary), Mr. M. V. Custance (Under-Secretary, Air Services and International Relations), Mr. G. I. Morris (Under-Secretary, Aerodromes), Mr. C. P. Scott-Malden (Assistant Secretary, International Relations) and Mr. G. V. Hole (Assistant Secretary, Aerodromes).

The Deputy High Commissioner, Mr. Sydney D. Pierce, and Mr. H. A. L. Pattison (Civil Air Attaché) represented the Canadian Embassy, and Mr. R. M. Campbell (Official Secretary), Air Commodore R. J. Cohen and Wing Commander J. J. McDowell, the New Zealand High Commission.

Captain R. Duffield, who commanded the Super Constellation that made the first commercial transatlantic flight for Qantas, represented the company's London manager, Mr. Russell Tapp.

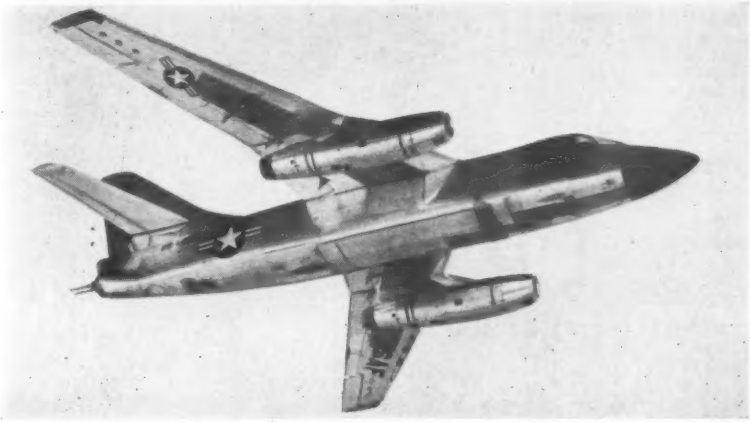
First in India

H. S. WILDEBLOOD, M.I.C.E., late of the Indian Public Works Department, who died last month deserves a mention as being probably the first person to design, make and try to fly an aeroplane in India. This was in 1912/13 at Meerut, United Provinces.

The machine, a triplane with forward stagger and a J.A.P. motor, had special lateral balances in which Wildeblood set much store. In *Aeronautics* of August, 1913, a long letter starts: "On June 22, 24 and 25 she lifted quite easily with a small movement of the elevator taking three or four hops of a few feet in height each time."

When one considers that he was not a pilot, that every kind of spare part must have been very hard to get and that this was done at the very height of the hot weather season, one appreciates that he must have been a man of determination and ability whose efforts, though unsuccessful, should not be quite forgotten by we sophisticated moderns.—J.P.

NEWS OF AIRCRAFT, ENGINES AND MISSILES



JUST ARRIVED.—The first eight Douglas B-66B Destroyers for the 47th Bombardment Wing, U.S.A.F.E., based at Sculthorpe, arrived on January 18. The remaining aircraft for the Wing were due to arrive during the week. Some RB-66Bs have been operating in this country since last spring.

CRASH CAUSE.—A statement by Scottish Aviation says that the crash of the Twin Pioneer G-AOEO in Libya on December 7 was caused by a "fatigue failure of the front vee-brace T-2 tube in the port wing across the last bolt hole securing the fork fitting." Modifications, which include the substitution of T-50 for T-2 tubes, were already incorporated at this point in production aircraft (G-AOEO was one of three pre-production Twin Pioneers) and these modifications have now been extensively tested.

TRIDENT ALOFT.—On January 17 Sud-Aviation stated that an S.O.9050 Trident II had exceeded the aeroplane height record of 70,310 ft. by reaching 72,100 ft. The Trident II has an S.E.P.R.63 rocket of 6,614-lb. thrust in the tail and a 3,300-lb. (with afterburning) thrust Turboméca Gabizo at each wing tip.

PIASECKI PLANS.—An agreement has been signed by the Piasecki Aircraft Corpn. and the French Breguet company for an exchange of technical and production information including the sharing of specific aircraft designs. This may well presage the building in America of the Breguet Intégral deflected-slipstream aeroplane.

POLARIS FIRING. — At Cape Canaveral, on January 17, another test firing of the U.S. Navy's surface-to-surface missile, Polaris, was successfully made. The Polaris is propelled by a solid-rocket motor, has a range of some 1,500 miles and is designed for firing from a submarine. Total funds made available for its development by Lockheed are in the region of £50 million.

CESSNA PRODUCTION.—The Cessna Aircraft Co., of Wichita, Kansas, produced and delivered 2,489 commercial aircraft worth $40 million during 1957. This is claimed as the highest number of commercial aircraft produced by any company during the year. Sales for individual types included 36 Model 170s; 939 Model 172s; 1,273 Model 180s, 182s and Skylanes; 150 Model 310s, and one Model 195. The total also includes 90 Model 305s, a variant of the U.S. Army's L-19 Bird Dog. These were sold to the French Government. Production of the new Model 175 is scheduled to begin in March next.

MORE C-133As.—According to *Aviation Week*, the U.S.A.F. Air Materiel Command has placed an additional order worth $40 million for the Douglas C-133A military transport. This will extend production of this type into 1961. It can be modified to transport Atlas and Titan ICBMs. Pratt and Whitney is proposing a new and more powerful version of the T34 turboprop intended primarily to power later models of the C-133. The engine should have better high-altitude characteristics and a number of other improvements. A picture of the C-133A is on page 121.

POLISH AMBULANCES.—The first helicopter was handed over on December 21, 1957, to the Polish Air Ambulance Service, which has its headquarters at Goclaw aerodrome, Warsaw. This aircraft, a version of the SM-1 (Polish-built Mi-1), will serve as a trainer for pilots who recently completed a theoretical navigation course organized by the Polish Ministry of Health.

HILLERS FOR HEALTH.—The Peruvian Ministry of Health has purchased two Hiller helicopters for its aerial ambulance service. A Piper Apache is to be acquired by whaling interests in Peru for use as a spotter.

HUSTLERS WANTED. — Gen. T. White, Chief of Staff of the U.S.A.F., has urged that production of the Convair B-58 Hustler be speeded up. The present B-58 schedule is only for an initial batch of 13 (of which the U.S.A.F. has seven), 17 in 1958 and 47 in 1959.

SPUTNIK DECEASED. — After remaining in orbit around the Earth for three months, Russia's Sputnik One disintegrated on January 4 after completing 1,367 circuits. This statement made by M. Federov, of the Russian Academy of Sciences in an article in *Soviet Aviation* is the first official Russian announcement of Sputnik One's decease.

ENGINES FOR THE NA.39.—It has been officially announced that the Blackburn and General Aircraft NA.39 strike aircraft is to be powered by two D.H. Gyron Junior turbojets.

MORE BOMARCS.—The U.S.A.F. has placed a second order with the Boeing Airplane Co. for the production of about 100 Bomarc surface-to-air missiles. The first production order, for an unspecified number of Bomarcs, was announced last September and was valued at approximately $139 million. The Bomarc, designed as a long-range defensive missile, is 47 ft. long and weighs 15,000 lb., and is powered by a ramjet supplemented by rocket boosters. It has hit its target more than 100 miles from the launching site. A Bomarc training base is now being built on an island in the Gulf of Mexico for operational testing purposes and for the training of U.S.A.F. missile crews.

M-185 DROPPED.—Fairchild have decided to abandon development of their M-185 four-jet executive and utility transport in order to concentrate on the F-27 Friendship, for which it has 62 orders and 22 short-term options. A mock-up and some components of the M-185 had been completed, and five had been ordered by three U.S. business houses.

VTOL COMMANDER.—Aero Design and Engineering is to build a VTOL flat-riser consisting of an Aero Commander fuselage and a deflected-slipstream system developed by NACA. Initially to be powered by two Lycoming flat-six piston-engines, the prototype will later have turboprops. An American source states, design work was by Robertson Aircraft Corpn., a subsidiary company.

C.G. ASSESSMENT.—A new method for assessing the correct C.G. of cargo aircraft by means of an electronic weighing system is claimed in *Sovietskaya Aviacya* by Prof. B. Dobrowolski. This system consists of three weighing mechanisms placed under the aircraft's wheels which send impulses to an electronic computor. It takes only 0.2 sec. to check the C.G., compared with 15 sec. with the current method used; the average error is only 0.1% compared with 0.5% previously.

GLIDING IN POLAND.—Announcing participation in the 1958 World Gliding Championships in Leszno, the Soaring Association of Canada is inquiring about the possibilities of hiring Polish equipment. In a letter written to the secretary of the Polish Aero Club (A.P.R.L.), the Canadians agree to meet all costs arising from use of Polish gliders (presumably SZD-8bis Jaskolkas), and transport for the period of the Championships, including a week of assimilating flights, which precede the official opening.

ALOUETTE ABROAD.—The American C.A.A. certificate of airworthiness for the shaft-turbine-powered Alouette helicopter was handed over in Washington on January 14 to M. George Hereil, president-general of Sud Aviation. The Alouette has a 340-h.p. Turboméca Artouste gas turbine and becomes the first French aircraft to have a C.A.A. airworthiness certificate.

COMMERCIAL AVIATION AFFAIRS

ATLANTIC MILLION.—For the first time the scheduled airlines carried more than a million passengers (an estimated 1,023,000) on the North Atlantic services. The reported shipping figure for last year was 1,030,000. The airline total includes 53,000 passengers carried on charter flights by the scheduled operators.

B.O.A.C. ROUND THE WORLD.—Speaking in San Francisco, Mr. Basil Smallpeice said that B.O.A.C. plan to open a round-the-world service in March, 1959, by linking their present route extremities of San Francisco and Tokyo with a service across the Pacific via Honolulu. The service, presumably to be operated by Britannias, will be the shortest of any one-airline round-the-world routes. Britannias will be introduced on the London-San Francisco service on April 3, to give an 18¼-hr. journey time.

EAGLE VISCOUNTS.—On February 3, Eagle Airways will introduce Viscount 805s on their Manchester-Hamburg-Copenhagen service. The aircraft are arranged for mixed class service, with 40 tourist class seats and 12 first-class. Complete first-class service, with excellent meals and free wines, spirits and cigarettes will be provided.

COST OF THE 880.—To date, Convair have expended or committed $50 million on development of the Convair 880 turbo-jet transport. The total includes $10 million in engineering costs. First flight of the 880 is scheduled for January 1959; 48 have been ordered to date.

CHANGING PATTERN.—M.T.C.A. statistics for activity at aerodromes in the U.K. during October show some interesting developments. Compared with October, 1956, the total number of movements increased by only 0.2%, but the number of passengers went up by 11% and the amount of freight on-and-off-loaded decreased by 14%. Mail went down by 6%. Major increases in passenger traffic were at Ferryfield (120%); Blackbushe (45%); Southend (43%); Blackpool (27%) and Manchester (26%). London Airport passengers increased by 8% and movements by 7%.

COMET'S LONGEST.—A de Havilland Comet 2E of the B.O.A.C. Comet Flight was airborne for 7 hr. 33 min. on January 19—believed to be the longest flight ever made by a Comet. It covered some 3,500 miles and landed with about 1,000 gal. of fuel in the tanks—enough for an hour's flying.

HUNGARIAN EXPANSION.—Malev, the Hungarian state airline, has introduced Il-14 services from Budapest to Berlin and Copenhagen, and to Tirana. Services to Brussels and Amsterdam are planned. Misrair is opening a Cairo-Budapest service and Air-India is expected to start a New Delhi-Budapest link.

QANTAS' 707s.—According to a U.S. correspondent, Qantas Empire Airways are scheduled to take delivery of their first Boeing 707-138 in May, 1959.

CIVILIANIZING HANEDA.—Japan Air lines have launched a drive to move the U.S.A.F. out of Haneda, Tokyo International Airport, where the Air Force has been in charge since the end of the war. According to J.A.L., the U.S.A.F. now uses almost three times as much space as all the civil airlines combined. All air traffic control, military and civil, is looked after by the Air Force.

B.E.A. PROFIT.—According to preliminary estimates B.E.A. recorded a net profit of £1,200,000 in the calendar year 1957.

SIGN OF THE TIMES.—According to the *Wall Street Journal*, Capital Airlines has reached an agreement with British interests to postpone payments for their Viscounts during the first quarter of 1958. A postponement until next April of these payments (amounting to nearly $1 million monthly) would help to bolster Capital's cash position during the months of poor traffic.

BOEING INTERCONTINENTAL.—The thirteenth Boeing 707 on the Renton production line will be the first of the bigger Intercontinental models—a 707-320 for P.A.A. This version is expected to fly next October and to be in service by the middle of 1959.

AUTO ALERT ON TEST.—A device developed from Selcal and Calsel, known as Auto Alert, is being tested by P.A.A. on the route between Fiji Islands and Auckland. This system enables the pilot, by using a push button, to alert ground stations that he is about to pass an RT message.

ANOTHER DC-8.—Trans Caribbean Airways, an American supplemental carrier recently certificated to operate scheduled service between New York and Puerto Rico, has ordered a Douglas DC-8. It will be delivered in December 1960, with economy-class seating for 176. Trans Caribbean has three DC-6As on order and expects to begin scheduled operations on March 1.

DOVE INCIDENT.—A de Havilland Dove of East Anglian Flying Service, Ltd. (Channel Airways) on a flight from Rotterdam to Southend made a forced landing on the beach at Dungeness on January 15. The pilot was slightly hurt, but the five passengers and the stewardess were uninjured. The aircraft had been diverted from Southend to Ferryfield because of fog, and, apparently, ran out of fuel.

NEWS ABOUT PEOPLE

WORLD TOUR.—On January 16 Mr. Basil Smallpeice, managing director of B.O.A.C., left for a World tour. In the course of the tour he will visit Boeing to see the Corporation's 707s and will talk to executives of Qantas and Tasman Empire Airways.

G.A.P.A.N. AWARDS.—The Guild of Air Pilots and Air Navigators has awarded Master Air Pilot Certificates to Capt. T. M. Bulloch, D.S.O., D.F.C., and Wg. Cdr. J. C. Reynolds, A.F.C. Capt. Bulloch is a pilot with B.O.A.C.'s DC-7C flight and has made over 460 North Atlantic crossings. Wg. Cdr. Reynolds is senior inspector of flying and chief operations officer with the Department of Civil Aviation in Rhodesia and has completed more than 5,000 instructional flying hours.

THE T.W.A. PRESIDENCY.—Following the resignation of Mr. Carter L. Burgess as president of Trans World Airlines (see THE AEROPLANE, January 10, p. 37), the chairman, Mr. Warren Lee Pierson has been named acting president—a post he will hold in addition to the chairmanship.

BRITISH EXPORT.—India's second Gnat was airlifted by two Indian Air Force Packets from Chilbolton last week-end for delivery to Kanpur. It was dismantled and ready for loading into the Packets within 6 hr. of a final test flight.

TEST PILOT.—Sqn. Ldr. James G. Harrison, A.F.C., has been appointed chief test pilot of A. V. Roe and Co., Ltd., as from January 1. He joined Avro's test team in 1954.

K.L.M. APPOINTMENTS.—Mr. D. E. Woolnough has been appointed U.K. agency manager of K.L.M. in succession to Mr. M. A. Cowee; he will serve also as deputy to Mr. A. J. Weight, the passenger sales manager. Mr. Woolnough is succeeded as reservations manager by Mr. F. Stokes.

F.A.A. PROMOTION. — Captain (Acting Rear Admiral) D. R. F. Cambell, D.S.C., R.N., who became Flag Officer Flying Training in October, 1957, has been promoted to the rank of Rear Admiral. Before his present post he was Director of Naval Air Warfare at the Admiralty.

ASTRONAUTICS CHIEF. — Brig.-Gen. H. Bushey, has been appointed Director of Astronautics, U.S.A.F.

AVRO PRESENTATION.—On January 17 apprentices at A. V. Roe and Co., Ltd., were presented with trophies by Sir Roy Dobson. Left to right, G. Tebay (Roy Chadwick Memorial Prize); W. Chadwick (Avro 504 Club Trophy); Sir Roy Dobson; D. G. Jackson (Freddie Bassett Trophy).

Photograph copyright "The Aeroplane"

R.Ae.S. GOLD MEDAL.—Mr. Jerome C. Hunsaker, Professor Emeritus, Massachusetts Institute of Technology, and NACA chairman from 1941 to 1956, is to receive the Gold Medal of the R.Ae.S. "for his contributions to aeronautical research and education, including his inspired chairmanship of the NACA." The presentation will be made at the I.A.S. Honors Night Dinner on January 28 by Sir George Edwards, president of the R.Ae.S.

SPERRY POST.—Mr. R. E. Leete, an assistant director of the S.B.A.C., has been released by the Society to become contracts manager of the Sperry Gyroscope Co., Ltd.

BLACKBURN PRODUCTION.—Mr. C. R. Russell, formerly with N. Taylor (Engineering), Ltd., has joined Blackburn and General Aircraft, Ltd., as assistant chief production engineer (aircraft).

DOWTY APPOINTMENT.—Mr. S. Hinchliff, production manager of Dowty Seals, Ltd., has been elected to the board of the company. He joined the Dowty organization in 1953.

AERO-MANPOWER. — Employment in the aircraft industry rose from 261,300 in September, 1957, to 261,500 in October. In January, 1957, the figure had been a peacetime monthly "high" of 266,600; it dropped to 259,500 in July and was 260,100 in August.

SKEFCO YEARS. — Five hundred employees of the Skefco Ball Bearing Co., Ltd., of Luton, have now completed 25 years' service with the company. The 500th to achieve this record is Mr. C. H. Peddar, of the automatic turning department, and on January 6 he was presented with an inscribed fountain pen and some savings certificates by the Mayor of Luton. The Skefco company has been at Luton since 1910 and to mark this long association with the borough the company's managing director, Mr. C. U. Magnusson, has presented a cheque to the Mayor for the purchase of a trophy.

MINISTER'S TOUR.—Senator S. D. Paltridge, the Australian Minister for Civil Aviation, left Australia on the inaugural Qantas round-the-World service on January 14, and will make visits in America and Europe before returning to Sydney on February 17. He will visit American manufacturers on the west coast, Sud-Aviation in Toulouse, Fokker in Amsterdam, and various British companies. He will also formally sign the U.K.-Australia Air Transport Agreement in London.

Books in the Running Brook

THE Aslib Aeronautical Group (of Librarians) gave further evidence of its enterprise and awareness of the needs of its members when it held a "Short Course on Aeronautical Documentation," on January 8 and 9.

About 25 delegates—largely comparative beginners—assembled at the College of Aeronautics on the evening of the 7th when Mr. Cyril Cleverdon, the Librarian of the College, gave an introductory talk. The next day Mr. A. H. Holloway, of the Ministry of Supply, spoke on "Reference Sources for Aeronautical Documents." Mr. Colin Cayless, of Vickers-Armstrongs, used the same title, but dealt with non-Ministry sources. Mr. Frank Smith (R.Ae.S.) dealt with British and Commonwealth aeronautical books, periodicals and reports, and Mr. Cleverdon handled the rest of the World.

On the Thursday (January 9), Mr. Alan Baker, of the M.o.S. Library, explained the ramifications of specifications and air publications and he was followed by Mr. R. C. Wright, of the R.A.E., on "Aeronautical Indexes and Indexing."

Apart from the usefulness of the lectures the course gave librarians an opportunity of meeting the actual people who have hitherto been only names or telephone voices and the good will that is built up in such circumstances cannot be overstressed.—F.H.S.

NAPIER POST.—Rear Admiral R. J. Pflum, U.S.N., (retd.) has been elected vice-president, sales, and a director of Napier Engines, Inc., of Washington.

INTERNATIONAL NICKEL POST.—Mr. E. C. Patterson has been elected a director of the International Nickel Co., of Canada, Ltd.

S. E. GLUHAREFF.—It is reported from Stratford, Conn., that Serge Eugen Gluhareff has died at the age of 54. He worked with Igor Sikorsky in pioneering rotating-wing and amphibious aircraft, and was project engineer for the S-38.

FAIREY SERVICE. — Mr. Richard Fairey, vice-chairman of the Fairey Aviation Co., Ltd., with some of the employees at the Long-service Association Dinner which we reported last week.

MILITARY AVIATION AFFAIRS

R.C.A.F. REORGANIZATION. — Four R.C.A.F. C-119s and approximately 150 personnel operating with the United Nations Emergency Force in the Middle East are to return to Canada next month. The R.C.A.F. No. 115 Communication Flight based at El Arish in the Gaza area is to be re-designated as an Air Transport Unit and strengthened by the addition of one Dakota.

RESTRICTED FLYING. — It was announced in Warsaw that flying over certain areas in Western and Central Poland will be prohibited for all civil and non-authorized military aircraft. This also includes civil and military Russian traffic between the U.S.S.R. and East Germany, which will be restricted to only two air corridors, in the east-west direction. A number of "round-the-clock" fighter patrols will force down any aircraft flying within the prohibited area.

ITALIAN C.A.S.—General Napoli has been appointed Chief of Staff of the Italian Air Force in succession to General Ferdinando Raffaelli.

U.S. AIR LOSSES.—According to the U.S.A.F. in Germany, 75 U.S.A.F. pilots and aircrew were killed in aircraft in Europe and North Africa in 1957. Seventy-eight aircraft were destroyed.

R.A.F. SHOW.—"The R.A.F. of 1958" Exhibition, which will be held in the Drill Hall, Bristol, from January 28 to February 1, will include a number of flying films, a working model of an airfield and several guided-missile models. Mock-ups of Canberra and Meteor cockpits will also be on show.

AIR TRANSPORT

The Bristol 200 . . .

WHILE the position over B.E.A.'s short-haul turbojet order was still undecided as we went to press with this issue, the Bristol-Hawker combine had announced a positive and independent new move in the game. A Bristol sales and engineering team, under Dr. A. E. Russell, Bristol Aircraft's chief engineer, had left, the announcement said, for the United States to discuss the projected Type 200 at the invitation of an unspecified American airline (believed to be Pan American). Other airlines will be visited during the tour, which was planned some weeks ago. At the same time some information about the Bristol 200 was issued.

As will be seen from the general arrangement drawing on this page, the Bristol project follows the expected and now accepted formula for future turbojet transports built on this side of the Atlantic—having its powerplants grouped at the rear of the fuselage. It seems from these drawings that the difficult question for the short-haul turbojet, of three engines or four, has now been finally resolved in technical and commercial discussions between B.E.A. and the manufacturers concerned—in favour of the three-engined configuration.

The Bristol 200 has its third engine within the fuselage, with the intake above the fuselage and forward of the fin into which the fairing merges. No information has been released by the manufacturers about the powerplants, but it may be assumed that the 13,000-lb.s.t. Curtiss-Wright Zephyr (derived from the Bristol Olympus B.Ol.6) could be a logical powerplant if 200s are sold to the U.S. market, while the Rolls-Royce R.B.141 might be the engine for a B.E.A. version if this were ordered.

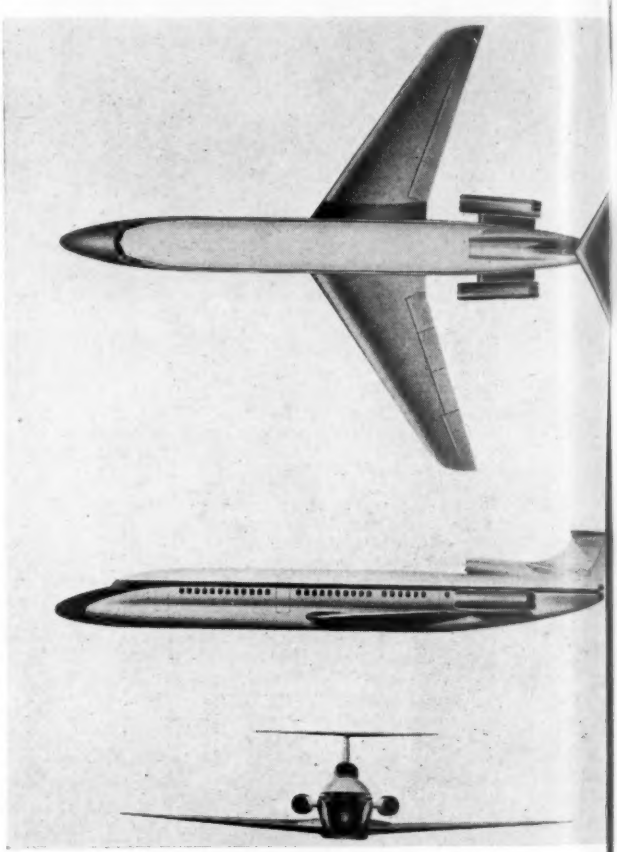
Hard information released by Bristol about the Type 200 includes the following:—

Span, 91 ft.	Capacity payload, 21,000 lb.
Length, 121 ft. 6 in.	Max. passenger capacity, 100
Max. gross weight, 120,000 lb.	Stage distance with capacity payload, 1,700 st. miles.
Speed, 600 m.p.h.-plus	

The manufacturer's statement adds that "the fundamental design consideration in the Bristol 200 has been its exceptionally high power/weight ratio which enables the aircraft to climb at a speed only a little below its high subsonic cruising speed and also makes possible the use of smaller airfields usually associated with the type of short-haul route for which the aircraft is intended." Bristol also claim that the power-reserve gives the 200 a better performance on one engine (33⅓% power) than that of present-day four-engined transports on two engines (50% power). The team visiting the U.S.A. is taking detailed operating analyses showing the performance of the aircraft on a wide variety of American domestic routes.

Meanwhile, discussions continued last week between representatives of the Ministries of Supply and Transport, B.E.A. and the two manufacturing groups concerned with the short-haul projects and between B.E.A. and the manufacturers. By Friday of last week, it had become generally understood that an attempt to bring Bristol and de Havilland together to work on the D.H.121 had not been successful and that Bristol preferred to continue their association with the Hawker-Siddeley Group in the Bristol 200 project.

Lord Douglas, chairman of B.E.A., was due to report on Tuesday to the Ministers of Supply and Transport on the results of his latest talks. At a dinner in Birmingham, on Friday, Mr.



The general arrangement drawing, above, and the photograph of a model, below left, show the main features of the Bristol project.

A. H. Milward, chief executive of B.E.A., said that this Corporation was in the "very unenviable position" of being able to make or break the British aviation industry, but pointed to the Viscount as an example of a Corporation-sponsored transport aircraft which had become a World-sales success.

. . . and the Boeing 720

MORE complete details of the Boeing 720 were released by the makers last week. As this aeroplane is the nearest U.S. competitor to the Bristol 200, the timing of the release was presumably no accident.

The 720, which we shall examine more fully in our next issue, is dimensionally similar to the smallest of the 707-120s (as ordered by Qantas) with a span of 130 ft. 10 in. and length of 134 ft. 6 in. Its primary differences lie in the reduced fuel capacity (a basic 8,400 Imp. gallons), lighter structure and a new lightweight version of the Pratt and Whitney JT3 engine. This is the JT3C-7, about 750 lb. lighter than the JT3C-6 and having a better specific fuel consumption.

The 720 can carry up to 130 passengers in the all-tourist configuration, and has, Boeing claim, a lower break-even load factor than any other intermediate-range airliner, including those with piston engines and turboprops. Max. structural take-off weight is 203,000 lb., and max. design payload 33,000 lb., which can be carried 2,250 nautical miles (with 13,000 lb. reserve fuel) using the cruise-climb procedure. With additional fuel (optional capacity is 11,220 Imp. gallons) the 720 will take a 10,000 lb. payload 3,500 nautical miles. On a standard day at sea level, the balanced field length required at 203,000 lb. take-off weight is 6,700 ft., and at the usual take-off weight of 185,000 lb. the field length required is 5,400 ft.

The Thinking Behind the V.C.10

IN last week's issue (p. 70) we outlined some new facts which were given about the Vickers V.C.10 turbojet transport by the manufacturers and first operators on the signing of the contract—and added a little information from our own sources. The B.O.A.C. contract—for 35, with an option on 20 more—was, in fact, signed the day after we went to press with last week's issue, so we were writing without the benefit of any crumbs of information which might be expected to be dropped at the Press conference after this important contract-signing occasion.

As it turned out—and as might be expected when Sir George Edwards of Vickers proceeds, in his humorous mock-diffident manner, to deal with any amateur inquisition—the crumbs were quite reasonably large pieces of bread. And this notwithstanding the fact that no airline operator appears to have been told very much about this medium-haul-stretched-to-long-haul turbojet transport for use in the years after 1963.

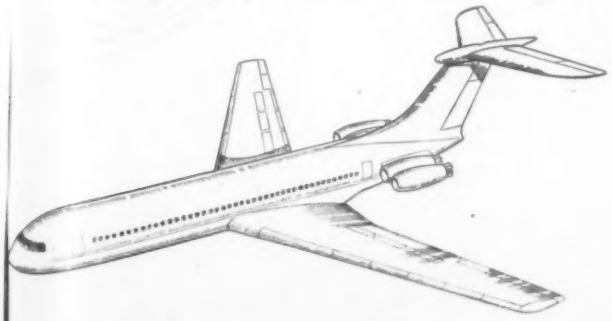
Naturally, only generalized answers could be expected in reply to questions about the ways and means by which a better airfield performance was being offered with a high-speed turbojet transport and about the developments which have permitted what was originally a medium-haul project to become a non-stop North Atlantic aircraft.

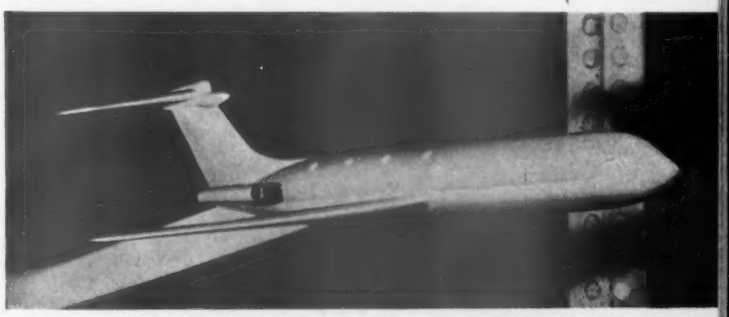
The first of these questions was answered, in effect, by the bald statement that the position of the powerplants at the rear was decided not on aesthetic or passenger-comfort grounds, but simply in order that the wing could be kept clear of all aerodynamically embarrassing encumbrances. This layout, in short, left the wing clean and allowed "things" to be put, to best advantage, on the leading and trailing edges. Apparently nothing especially clever—in the way of blown flaps and so forth—is being considered, though such devices may well be possible in later developments. Accepted and well-known aerodynamic methods are to be used to obtain the good take-off performance which is being promised.

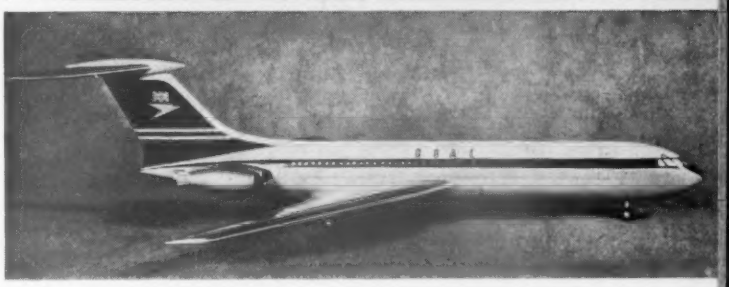
The lift devices on the wing, which Sir George described as "things," can be seen in the outline drawing below which has been made from the latest V.C.10 model. So far as can be seen, these include leading-edge flaps, spoilers at two-thirds chord in the centre-wing area, a slotted flap system and conventional two-piece ailerons.

The long-haul capabilities of the V.C.10 have followed the expectation of increased thrust from the Rolls-Royce Conways and the use, presumably, of a very efficient structure. Not even a whisper was offered at the conference in the way of a figure for the Conway's future thrust or specific consumption—but one might hazard a guess that the V.C.10's chameleon performance could only be offered, without excessive penalties in structure-weight, with the help of "boosted" thrust, a well-considered disposition of fuel to provide the best in the way of wing-bending relief and, perhaps, lift devices which can be used effectively during the climb and early part of the cruise as well as during the take-off.

The only guide to future Conway take-off power can be obtained from the fact that the military version has been type-tested at 17,500 lb. s.t. It can therefore be expected that, by 1963, something of the order of 20,000 lb. or more per power-plant may be available (with or without water-injection), with a comparable continuous power rating to meet engine-out climb requirements from high-altitude and/or tropical airfields.







The photographs above show three successive stages in the aerodynamic and general development of the V.C.10 project. At the top is an earlier wind-tunnel model; in the centre is the B.O.A.C. model which shows an interim stage of detail design; and below this is a photograph of the latest Vickers model. Note the changes in tailplane position and in the arrangement of the fairing bullet. Below, left, is a drawing made in THE AEROPLANE offices to show the disposition of the various movable surfaces so far as these can be seen in the latest model.

The V.C.10 was primarily designed to offer a good take-off and initial climb performance in difficult conditions and out of limiting airfields; the remainder of its capabilities have just been "allowed to happen." The V.C.10 will appear three years after the American turbojet transports—so it not only should be, but had to be better.

In hard facts, Sir George gave the following figures:—

Maximum gross weight (long-haul): 299,000 lb.	Height: 41 ft. 2 in.
Span: 140 ft.	Wing area: 2,800 sq. ft.
Length: 158 ft.	Passenger-floor width: 11 ft.
	Fuselage width: 12 ft. 4 in.

Although he stressed the fact that cruising speed, so long as this was reasonably high enough, was unimportant in comparison with take-off and consequent payload-range performance

in difficult conditions, Sir George said that the V.C.10 would be faster than the Boeing 707 with similar powerplants. Pressed to define the word "faster," he gave an advantage figure of M=.02 (12-15 m.p.h.) for the long-range cruise at 40,000 ft.-plus.

The high maximum gross weight—299,000 lb. by comparison with 287,500 lb. for the long-range DC-8 and 295,000 lb. for the Boeing 707 Intercontinental—suggests either a sensible degree of objectivity over weight estimates, or, possibly, that the long-range V.C.10 has been designed to carry more fuel than either of the U.S. aircraft. The fuselage width, at 12 ft. 4 in., is greater than that of any existing or projected turbojet transport.

Asked about production, Sir George did not consider that there would be any particular problem, and added later that such an expensive and large aircraft, coming after the DC-8 and 707, was not likely to demand an exceptionally fast rate of initial output. We might comment here that the V.C.10 will first be filling in the equipment gaps after American turbojets have been delivered and, later, will be providing necessary additions to the airlines' fleets as traffic increases—though there will obviously be special-case buyers, such as Air France and K.L.M., with intercontinental networks similar to those of B.O.A.C.

The first V.C.10 is due to fly in 1961 and the Corporation will receive a "fleet" (presumably not less than 10) in 1963. The remaining aircraft, including those on option, will be delivered in 1964-65. Sir George considered that purchases might be slow and steady, but could continue into the 1970s.

Mr. Basil Smallpeice, who signed the contract for B.O.A.C., said that the Corporation would have an all-turbine (but not necessarily all-turbojet) fleet by the mid-1960s. He agreed that the V.C.10 purchase meant that the Corporation was envisaging a trebling of ton-mile production by the time the entire fleet was in service. The V.C.10s would not necessarily replace the 707s on the North Atlantic, but would be used where their particular capabilities showed an advantage and the aircraft on option were also required primarily for the medium-stage Commonwealth and South American routes. It might be added here that the 707s are specialist long-haul aircraft, and that there would obviously be no point in replacing them on the Atlantic or similar routes until a sufficient number of V.C.10s are available to make a one-type turbojet fleet an attractive economic proposition for the Corporation.

New Comets Coming On

THE next stage of development flying with the Comet 3 G-ANLO will begin soon, with thrust reversers fitted to the two outboard Avon R.A.29s. All four engines already have noise suppressors. The thrust reversers are of the type developed by Rolls-Royce, and the installation in the Comet will provide outlets in the top and bottom wing, each covered by a pair of hydraulically-actuated doors. Some preliminary experience with a thrust reverser was obtained on the Avon-engined Comet 1 G-ALYT some time ago, in a brief series of trials with one engine in permanent reverse.

The next important stage in Comet 4 work at Hatfield will be the beginning of the water-tank test, using the second completed airframe. The first aircraft, G-APDA, is near to roll-out and after it has been resonance-tested it should begin its flight trials in the early spring. Thereafter, production from both Hatfield and Chester should build up quickly, to enable B.O.A.C. to get the aircraft into service towards the end of this year.

The first Comet 4B for B.E.A. will fly in the middle of 1959 and the six aircraft of this type should all be in service in 1960. Before the first 4B flies, the Comet 3 will probably be flown with the short-span wings; detachable outer wing panels were provided when this aircraft underwent an extensive refit a year or so ago. Although not wholly representative, so far as systems, some structural details and ultimate gross weight are concerned, the Comet 3 is in fact proving a most useful vehicle in the preliminary work of obtaining a C. of A. for both the Comet 4 and the 4B.

Decca and Turbojet Approach Patterns

EARLY in December last year we learnt that experiments had been, or were being, made with a Decca-equipped de Havilland Comet to check the ability of turbojet aircraft to follow particular holding patterns and approach paths to a runway. Some information about the results of these important tests was issued by Decca last week and we were also able to see a photostat copy of one of the Flight Log charts on which a particular holding and approach pattern had been traced.

The Comet used for the tests was a 2E flown by B.O.A.C. crews on behalf of the M.T.C.A. Air Traffic Control Experimental Unit and these practical experiments followed studies of the problem which had been made on the radar trainer at Hurn Airport, Bournemouth. The flight trials were completed off the North coast of Scotland (near the Orkneys) so as to be free of interference from other air traffic and so that, using the North Scottish Decca chain, the results would simulate those to be expected from the pattern near London Airport. The entire series of studies and flights were concerned with the sequencing of turbojet and piston-engined aircraft into an even and rapid flow towards an airfield's threshold.

It is now well understood by everyone that turbojet aircraft must, for best results, be allowed to make, so far as is possible, an uninterrupted descent from cruising altitude, and the crew must, therefore, be able to position the aircraft accurately throughout the final part of a flight and particularly during the last stages of the descent. For such positioning at high altitudes, radio beacons are, because of the wide spread of the cone or fan, not particularly satisfactory.

For these flight trials, track lines, indicating specific flight paths to be followed, were drawn on the Flight Log charts together with altitude indications and other necessary information, so that, simply by flying the aircraft by reference to the Flight Log, the crew were able to carry out a number of different procedures with precision—descending from operational altitude down to an imaginary runway so accurately (Decca tell us) that for a series of trials the average time-error at the departure-point from the holding pattern was only nine seconds.

The reproduction of the particular chart in our office shows three holding patterns in the area marked out for landings in an easterly direction. One pattern is for four minutes', one for six minutes' and the third for eight minutes' holding duration at 20,000 ft. From these patterns, an ideal descent track is shown for the particular conditions, with a turn in on finals about 20 nautical miles from the imaginary threshold, a final-approach "gate" and a "runway" in the ocean.

The track is marked with the calculated best heights at different distances from the "gate" (five miles from the threshold) and touchdown. On the chart can be seen the Flight Log stylus track made during one of the runs to this pattern and it is obvious that the use of Decca allows an accurate track to be flown, while the best-altitude marks allow the crew to adjust the descent accurately to the turn-in point and thence to the "gate," which is passed at 1,500 ft. The basic holding and track pattern is drawn to make allowances for the estimated speed of the wind—which was assumed, in the chart we have, to be blowing from about due east.

It is expected that further trials will be completed in the near future.

B. O. A. C. APPOINTMENT—As we recorded briefly in last week's issue, Mr. Keith Granville, C.B.E., previously commercial director of B. O. A. C., has been appointed to the new post of deputy managing director of the Corporation. Mr. Granville joined B.O.A.C.'s predecessor, Imperial Airways, in 1929.

Background to a Safari Service

GLAD though the Safari passengers may be to have an all-daylight passage and to be able to sleep in a bed during the intervening night of a two-day journey—the Airwork/Hunting-Clan West African tourist service poses some interesting problems of planning, diversion and navigation. It also has an interesting political aspect.

In last week's issue we dealt briefly with some general impressions of an out-and-home trip on this service. In this article we shall take a look at a few of the detail factors involved in the operation of a service flown with modern equipment, but to an "old-fashioned" daylight-flying formula.

First of all it should be explained that—regardless of passenger preference and the possible sales appeal in meeting the preference—this West African service is flown with a night-stop and by daylight for simple practical reasons. With no more than a once-weekly frequency—shared by two carriers at that—the slip-crew technique would be impracticable on economic grounds. For such a technique to be economically desirable it would probably be necessary for the frequency to be stepped up to three services a week in each direction.

As it is, the same flight and cabin crew makes the out-and-home journey in four successive days and—at least for the flight crew—the statutory off-duty periods must be fitted in and it is convenient to do this with the aid of a night stop. In fact, on the longer Safari flights to Nairobi and Salisbury, the first part of the journey is completed at night and a long overnight stop is made, starting half-way through the first day—but that is an arrangement for operating convenience and passenger interest. For the West African service a daylight-only schedule fits in very well—and, it might be added, this suits the somewhat limited navigational and other aids which are available on that coastal route.

Schedule Problems

The schedule is, as it happens, planned as a compromise between statutory flight-time limitations, diversion arrangements, maintenance work and passenger comfort. Everything fits in well so long as there are no unreasonable delays—and even these can be borne by everyone except possibly by the maintenance engineers who have to get the Viscount back on the starting apron at London Airport in time for the next scheduled service or charter flight.

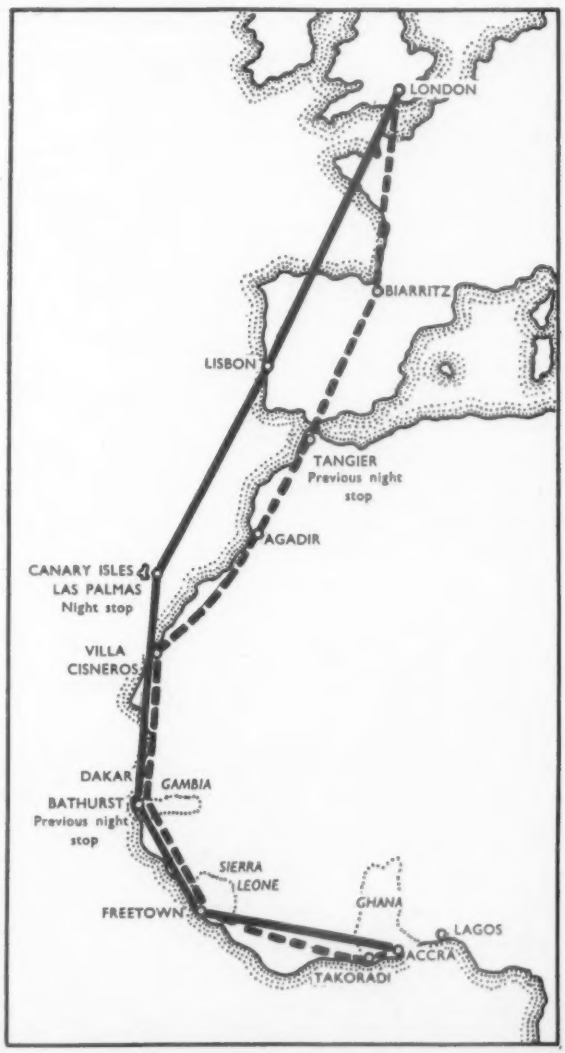
So far as the outsider can see it, there are, from the duty-time limitation viewpoint, two critical points in the out-and-home flight and one from the diversion viewpoint. There is time in hand on the outward journey to allow for a late arrival at the Las Palmas night-stop, but none (or very little) after a late arrival at Accra if the crew are to have their statutory rest before the return service. The starting-time for the return has then to be moved accordingly. And the same applies to the night-stop at Las Palmas on the return journey after the two-stop 10-hour haul (plus flight-planning time) out of Accra.

If the service is running late there is a diversion problem on the Bathurst-Gando (Las Palmas) sector. While on the outward journey the aircraft can make an en route diversion into Agadir, if the Gando weather looks unpromising, a similar diversion cannot so easily be planned on the return journey. Normally, the diversion on the northbound run to Las Palmas would be Villa Cisneros, but this is a daylight-only airfield and cannot, therefore, be flight-planned as a diversion if the service is late. The arrangement in these circumstances may be to land at Dakar to top up with enough fuel to divert to Agadir and to have adequate reserves in hand. Dakar, incidentally, is an admirable bad-weather haven for the area and has a radio range, VDF and ILS, whereas some of the other West African airfields offer no more than non-directional beacons and locators. Such aids are adequate enough in daylight conditions, but can be time-consuming when an arrival is being made in poor visibility after nightfall.

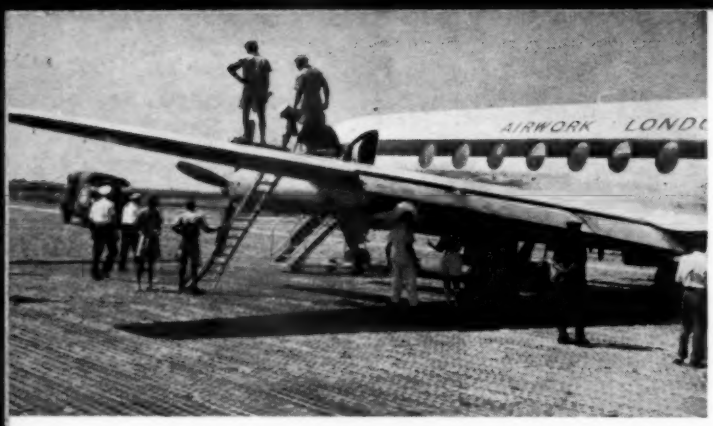
The way in which lateness of arrival can be further delaying was demonstrated at Gando (Las Palmas) on the outward journey—though, in this case, with visibility reduced by fine sand from the Sahara to about three kilometres, the fact that we arrived after dark may not have been particularly significant. When approaching Gran Canaria we let down early, on a necessarily DR basis, to the local safety height of 9,500 ft. and held that altitude until we had passed over the beacon. We then completed a procedure let-down over the sea before making the final approach. Those among the passengers who complained about the delay should have been adequately comforted on the following morning when they could see, in the early sunlight, the lunar landscape which this routine procedure was designed to avoid.

On that morning, too, some of us felt that we had moved in space and time and had been landed on a War-time aerodrome in Germany; beside the runway were squadrons of Heinkel 111s. and some Junkers 52s (both types made in Spain) which are still used by the Spanish Air Force. Other 15-year-old memories were evoked by the sight of the runways and apron at Bathurst, which are surfaced with Laterite and our old friend P.S.P. (pressed steel plate). It makes a fine old clatter on touch-down and take-off, but seems to be firm enough and is a good deal better than the wire-net tracking on which we wallowed about at some satellite airfields during those bad old years.

The Safari service is scheduled with 30-minute turn-rounds. These will be practical in due course when pressure-refuelling equipment is available at all points. On the inaugural flight



This map shows the various airports and alternates on the Safari service to West Africa. The broken line shows the old route.



Preparing to refuel at Bathurst. Slow "gravity" methods had to be used on the inaugural flight. Pressed-steel plate is used for the apron and runway surfaces at this airport.
Photograph copyright "The Aeroplane"

fuelling was, for the most part, completed by normal gravity means—and was, in one case, completed "manually" after a temporary breakdown of the equipment. Considering the circumstances, the stops, though not quite of the 30-minute order, were commendably quick, and the turn-outs of the ground teams were quite magnificent as they stood to attention and saluted when we taxied out. At Dakar, our one unscheduled stop, they had prepared the mixture for our tanker overnight and one was glad that civil aviation facilities are so truly international and unquestioningly provided.

Because Ghana is now an independent Commonwealth country this West African Safari service is no longer Colonial Coach, but is the only intercontinental tourist service operated by British independents. Hunting-Clan and Airwork are permitted to continue their operations over this route on the understanding that they do not offer a capacity greater than 30% of that offered by B.O.A.C. tourist services. This proportion appears to be fair enough—until one remembers that the capacity offered by the Corporation does not include that of W.A.A.C. long-haul services operated by B.O.A.C.—and will not include that which may be offered in due course by the Ghana national airline, which will possibly be B.O.A.C.-operated.

In the end, the Corporation, as such, may fly no tourist services to and from the West African area—and 30% of nothing is not a very large share on which to make a living. It is unlikely that the Government and the A.T.A.C. will reduce the Safari frequency below the once-weekly schedule at present maintained—but, whatever the traffic may be, the future does not seem to be particularly promising unless there is a change of policy. Meanwhile, one supposes, Airwork and Hunting-Clan should be grateful for permission to operate such a tourist service—however limited in its development possibilities. At least the decision to allow this independent tourist operation has created quite a precedent.—H.A.T.

The No-Go Problem

WHEREAS the no-show passenger is an uneconomic embarrassment for an airline, a no-go aeroplane is a distinct awkwardness for an intending passenger who is intent upon arriving, rather than travelling hopefully for several hours. This was brought home recently when the following sequence of events took place, more or less as under:—

18.20. Departure time for B.E.A. flight to Amsterdam.

18.25. Announcement over loudspeakers in departure hall that weather is bad at Amsterdam and a telephone call is expected. (Visions of a frantic Dutchman delving into pockets of baggy trousers for small change.)

18.35. Second announcement that no message has yet been received.

18.45. Third announcement stating that a call from Amsterdam is expected at any moment. (Visions of even more frantic Dutchman in telephone box with change, but having trouble with operator who cannot understand why the two airports are not connected by radio.) Offer of free light refreshments with the compliments of B.E.A.

18.46. Rush to bar after short pause to give lady passengers a start, only to find that refreshments in bottles are not covered by this otherwise kind offer.

18.50. Settle back in chair, eating sandwiches and drinking coffee.

19.00. Personal appearance of apologetic B.E.A. man who states that the call from Amsterdam (visions of Dutchman relaxing with large gin) confirms worst fears of weather and that the B.E.A. flight is regretfully cancelled because of fog.

19.30. Inquire about flights next day and am offered several flight times which are too early to make from wilds of Outer London. (Visions of free accommodation in "Splendide" at B.E.A. expense.)

19.31. Hear mention of possible K.L.M. flight later tonight. (Visions of arriving in Amsterdam in the early hours, having lost an hour because of change to Continental time.)

19.31¼. Politely ask when K.L.M. flight is.

19.31½. Am told it is at 20.00 hrs.

19.31¾. Ask why K.L.M. can fly at 20.00 if B.E.A. cannot contemplate operating at 19.30.

19.32. Pained silence.

19.32¼. Explanation by B.E.A. that the weather conditions are "below our operating limits" but that I can "take a chance" with K.L.M. (Visions of storm-racked passage with St. Elmo's fire, fog-bound airport and eventual crash.)

19.33. Book to fly K.L.M. at 20.00.

19.35. Board coach to London Airport North.

19.35¼. Dutch girl asks if K.L.M. aeroplane is a Viscount.

19.36. Dutch girl leaves coach when informed that it is not.

19.45. Pass Customs and immigration for second time with feeling of bored anticipation.

20.00. Take-off for Amsterdam in a comfortable aeroplane which has only two seats on each side of the gangway.

21.10 (22.10 local time). Arrive at Schiphol in clear weather to find that the fog has turned to rain and the rain dries on the way into Amsterdam in the coach. Pleased to find that coach fare remains at one guilder. (B.E.A. coach fare in London also remains at 5s. despite shorter ride and 10-min. walk from nearest Tube station to shiny new terminal.)—D.G.

FIRST FOR C.P.A.—Taking off from Sydenham Airport for its maiden flight on January 11 is the first of five Britannia 314s built by Short Brothers and Harland, Ltd., for Canadian Pacific Airlines.

THE FIGHTING SERVICES

Senior R.A.F. Postings

AIR COMMODORE A. L. Derry, C.B.E., Director of Personnel (Ground) at the Air Ministry for the past two years, has become Air Officer Commanding, the R.A.F. Record Office, Gloucester. Before going to the Air Ministry, Air Cdre. Derry was Group Captain in charge of Organization at Home Command.

The post of Director of Personnel (Ground) has been taken over by Gp. Capt. C. V. Mears, C.B.E., with the acting rank of Air Cdre. He has been Senior Officer in charge of Administration at Headquarters, No. 90 (Signals) Group, since 1954. Between 1951-4 he served as a Deputy Director of Intelligence at the Air Ministry.

Kelly Memorial Plaque

IT IS proposed to place a Memorial Plaque in the Chapel at the Britannia Royal Naval College, Dartmouth, to the memory of Lieut. Cdr. D. P. W. Kelly, R.N., who was killed in a flying accident at R.N.A.S. Ford on August 26, 1957. He entered Dartmouth as a Naval Cadet in January, 1940, and served at the College from January, 1956, until December, 1956, as Divisional Officer of the St. Vincent Division.

Lieut. Cdr. Kelly is thought to have had many friends in aviation circles who may wish to contribute, and it is requested that any donations should be sent to the Captain, Britannia Royal Naval College, Dartmouth, Devon. Cheques should be crossed "Lieut. Cdr. Kelly Memorial Fund." Any surplus money remaining in the fund after the purchase of the memorial will be used to establish a prize to be awarded annually to the most promising cadet passing through the flying course at R.N.A.S. Brawdy each year during Phase Two training at Dartmouth.

Transport Efficiency Competition

IN THE 1957 R.A.F. Inter-Command Mechanical Transport efficiency competition the top honours have been shared by R.A.F. Feltwell, Flying Training Command, which was judged the most efficient station of the year in the senior division of the contest, and by R.A.F. Amport, Maintenance Command, judged the winner in the junior section for smaller stations.

Top senior stations in each of the other commands were Ballykelly (Coastal); Dishforth (Transport); Gaydon (Bomber); Henlow (Technical Training); Odiham (Fighter); Rufforth (Maintenance); Ruislip (Home) and Watton (No. 90 Group). The other Command's top stations in the junior contest (for stations with less than 35 vehicles) were Digby (90 Group); Hornchurch (Flying Training); Titchfield (Home); Mildenhall (Bomber); Mount Batten (Coastal); Upavon (Transport); Buchan (Fighter); and Hawkinge (Technical Training).

Five Out of Six

FLYING OFFICER P. BRIGHTON, now under advanced flying training at No. 5 F.T.S., R.A.F. Oakington, won five of the six trophies awarded to his course—No. 134—during his basic flying instruction at No. 6 F.T.S., R.A.F. Tern Hill. He won the flying, aerobatics, navigation and ground school trophies, and the Eustace Brooke Lorraine Trophy awarded to the best all-round student on the course. In addition, he equalled the previous highest marks awarded for the tests by the Central Examining Board.

Receiving a permanent commission in the Technical Branch in August, 1955, Flg. Off. Brighton attended the O.C.T.U. at R.A.F. Jurby until October, 1955, and entered the R.A.F. Technical College, Henlow, in September, 1956, for the electrical engineer course. From Henlow he went to Tern Hill for basic flying training.

A.T.C. Gliding Expansion

A NEW gliding school for A.T.C. cadets was to be officially opened at R.A.F. Turnhouse on January 18 by the Senior R.A.F. Officer, Scotland, Air Vice-Marshal P. D. Cracroft, who is also the Commandant, Air Cadets, Scotland. This new unit —No. 661—is the only A.T.C. gliding school in Scotland and will provide gliding facilities for cadets from Edinburgh, Glasgow and the south of Scotland.

A.T.C. cadets from the north and east of Scotland, however, who at present have no gliding school because of the closing down of R.A.F. Edzell, will be happy to know that the Air Ministry is exploring the possibilities of opening two more schools, which will probably be located in these areas.

R.A.F. Appointments

THE following are among recent R.A.F. appointments:—

Wing Commanders: A. Boonham to Headquarters, No. 90 Group, for technical staff duties; C. H. C. Down, M.B.E., to Headquarters, No. 19 Group, Coastal Command, for technical duties; M. A. Ensor, D.S.O., D.F.C., A.F.C., to the Maritime Operational Training Unit, Kinloss, to instruct; C. G. St. D. Jeffries, D.F.C., to R.A.F. Lyneham, for flying duties. F. C. Lowe to Air Ministry, for duty in the Department of the Chief of the Air Staff; J. W. McKelvey to Air Ministry, for duty in the Department of the Chief of the Air Staff; D. L. Prichard, D.S.O., to Headquarters, Transport Command, for administrative staff duties; D. S. Sanderson to Air Ministry, for duty in the Department of the Air Member for Supply and Organization; T. Wharton to R.A.F. Changi, Singapore, for technical duties.

Squadron Leaders: F. E. Barnes to the Ministry of Supply (exchange post in the U.S.A., with the acting rank of Wg. Cdr.); B. Brooke to the R.A.F. Technical College, Debden, to instruct (with the acting rank of Wg. Cdr.); G. E. Jones to the Air Ministry, for duty in the Department of the Chief of the Air Staff (with the acting rank of Wg. Cdr.); G. A. Sentance, M.B.E., to R.A.F. St. Athan, for administrative duties (with the acting rank of Wg. Cdr.); J. W. S. Smith, M.B.E., D.F.C., A.F.C., to R.A.F. Kirkbride, to command No. 12 Maintenance Unit (with the acting rank of Wg. Cdr.).

Reunions

No. 84 Squadron.—A reunion will be held at the "Artillery Arms," Rochester Row, S.W.1., on March 8, 1958. Tickets, price 7s. 6d., can be obtained from Mr. O. Greenwood, Flat 11, 62 Belgrave Road, London, S.W.1.

R.A.F. Equipment Officers.—The next reunion will be held at Simpsons, Strand, London, on February 21, 1958. Tickets, price 23s., may be obtained from Mr. R. H. Cain, Greenhayes, Tilford Road, Farnham, Surrey.

FAREWELL PARADE.—Before leaving for its training detachment with the R.A.F. in Aden earlier this month (THE AEROPLANE, January 3) No. 1 Squadron (Sqn. Ldr. C. Paxton), Royal Rhodesian Air Force, was reviewed at a farewell parade by H. E. the Governor-General of Rhodesia and Nyasaland, Lord Dalhousie. Based at New Sarum, the Squadron is equipped with Vampire Mk. 9s.

Postscript to Pinecastle

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CONTRARY to the impression conveyed by Press reports at the time, an evaluation of the performance of the R.A.F. contingent in the 9th Strategic Air Command Bombing, Navigation and Reconnaissance competition, which took place in the United States towards the end of 1957, has shown that the difference in bombing accuracy between British and U.S. crews is negligible. The results achieved by the Valiants of Bomber Command were virtually the same as those of SAC's B-52s, both types of aircraft having been in service for similar lengths of time, and the Vulcans' performance was commensurate with their period of service.

The vital point about the R.A.F. results was that every one of the bombing attacks in the SAC competition would have achieved the desired effect with nuclear weapons, and they were all within the inherent accuracy limits of the radar bombing equipment in use. Another extremely creditable R.A.F. achievement, reflecting great credit on the ground crews, was that of all the 90 aircraft taking part in the competition, only the four Valiants and the veteran Convair B-36s had no abortive missions through unserviceability or other causes, and no gross bombing errors (outside the immediate target area).

So although the R.A.F. did not win the competition, the Bomber Command teams made the essential point that they were at least in the same class as the SAC crews, despite the odds of 86-4, and were considerably better than many of the participants. They also exceeded the estimates of Air Vice-Marshal S. O. Bufton and Wg. Cdr. L. Trent who, after attending the 1956 SAC bombing competition, considered that any of the R.A.F. teams would do well if they finished among the first half of the contestants. As it happened, the leading R.A.F. Valiant crew, captained by Sqn. Ldr. R. W. Payne, came 11th out of 90 in the overall results, and even the most unsuccessful Vulcan, with its serviceability teething troubles, had half a dozen U.S.A.F. B-47 crews behind it.

This is all the more remarkable when not only the relative lengths of service of the Vulcan or Valiant, and the B-47 are compared, but also the circumstances of the actual competition. This series was started in 1948 by General Curtis Le May, then commanding Strategic Air Command, and has been held annually since then. Its object is to improve operational efficiency, but tremendous prestige has grown around the competition in SAC, and the winning crew receive spot promotion when the results are announced. The commander of the winning wing also comes into the limelight, so that competition could not be keener, and the event has become the highlight of the year in SAC.

This massive Command has some 2,000 crews to choose from for the annual competition, compared with a fraction of that number in Bomber Command, and many of those taking part have, naturally, been chosen every year for up to the full period over which the event has been held. They are therefore highly trained and completely familiar with their equipment, which has settled down in service, as well as knowing every detail of the target complexes used in the competitions.

In the United States, a number of prominent industrial areas, such as Kansas City, St. Louis, Atlanta, etc., are used as training targets, and radar bomb scoring units are permanently positioned in their vicinity. SAC crews have used these for simulated radar bombing attacks for many years, so that they are all very well known, and although the targets within the complexes are changed for the competitions, the same offset points (prominent radar responses which can always be picked up) can still be used. To reduce the advantage which familiarity with these offsets confers on the U.S.A.F. crews, a Bomber Command Valiant was sent over to Canada in August, 1957, to photograph all the radar pictures presented by the U.S. target complexes. It did this in 10 days and returned the prints to be studied by the Bomber Command competition teams.

The 3 Group Flight was formed at Wittering early in the same month, with four brand-new Valiant BK1s, fully modified by Vickers to the latest operational standards, with underwing tanks, automatic pilots, radio compasses, and flight refuelling equipment. Although the first Valiants had been received by Bomber Command in February, 1955, at the Gaydon O.C.U., they were not equipped to operational standards, and none of the subsequent deliveries had the full radar bombing equipment until the end of 1956.

The Valiants which took part in the Suez campaign operated in their secondary rôle of medium-range bombers with high-explosive weapons, using visual aiming techniques in conjunction with target-marking or pathfinding in the classic style. Their primary rôle, of course, is long-range radar bombing with nuclear weapons, but they were not able to begin practising this until the beginning of 1957.

Little more than six months had therefore been available to the Valiant crews to work up with their radar-bombing equipment prior to the formation of their Competition Flight, and in No. 1 Group the Vulcan teams were in point of fact in an even less enviable position. The Vulcan crews had converted to their aircraft only in February/March, 1957, and the first squadron had been formed in May. The late delivery of aircraft and the modification requirements caused great difficulty in achieving a minimum training programme. Oddly enough, the Vulcans had managed to win Bomber Command's own overall navigational and bombing competition, which was run very much on the lines of the SAC event, except for the shorter

distances involved, and this gave an idea of the aircraft's potentialities once its equipment had time to settle down.

As a matter of interest the selected Valiant crews averaged about 500 hours experience on their aircraft, and the Vulcan crews had about 100 hours on type. These figures compared with the SAC crew average of about 1,500 hours or more on type.

The Vulcan and Valiant Teams

The Bomber Command crews selected for the SAC competition were led by Wg. Cdr. A. D. Frank, D.S.O., D.F.C., O.C. No. 83 Squadron, and Wg. Cdr. C. C. Calder, D.S.O., D.F.C., flying two Avro Vulcans of No. 1 Group; and Sqn. Ldr. R. W. Payne, the training officer of No. 214 Squadron, Marham, and Flt. Lt. R. Mather, D.F.C., A.F.C., of No. 138 Squadron, Wittering, in the Valiants of No. 3 Group. Each team was accompanied by a spare aircraft. The R.A.F. contingent also included Air Marshal Sir Harry Broadhurst, A.O.C.-in-C. Bomber Command, in his own Vulcan, and Air Vice-Marshal K. B. B. Cross, A.O.C. No. 3 Group, in his Valiant. The two senior officers toured SAC bases in the United States shortly before the competition, and were naturally considerably impressed by the scale of effort of the U.S.A.F.

An advance party of maintenance personnel went to Pinecastle, Florida, by Comet, about two weeks before the competition to set up their mobile workshops, including the vital electronics centre. Serviceability is particularly important in the SAC competition, since the two participating aircraft had between them to complete one mission per 24 hours throughout the competition, or virtually fall out of the running. In this respect, Bomber Command was in a particularly vulnerable position, as it was the first time a Vulcan Flight had operated overseas.

The R.A.F. participants were based at Pinecastle Air Force Base alongside the resident B-47 unit, the 321st Bomb Wing (M), and the other Stratojet teams, which were drawn from 33 wings of Strategic Air Command. In addition to the 66 competing B-47s, there were also 10 Boeing B-52s and 10 Convair B-36s from the heavy bomber wings of SAC, based at Carswell AFB, resulting in 86 U.S.A.F. crews from 43 wings taking part in the competition.

Unfortunately for the R.A.F. teams, the SAC event is naturally geared to the performance of its aircraft, which in certain respects is different from that of the British aircraft—which had been designed to a different set of requirements. In this, the Vulcans were more handicapped than the Valiants.

On the credit side, however, was the unlimited assistance and hospitality extended by the Americans, who from the time the competing R.A.F. teams arrived, on September 23, did everything possible on and off the base to look after their guests. The Pinecastle-based 321st Bomb Wing helped to familiarize the R.A.F. crews with local operating conditions in their practice runs, before the start of the competition on October 30.

The competition ran for six nights, during which each crew was required to fly three sorties, flying on alternate nights. Each sortie included three radar bombing runs and one night celestial navigation leg, and to qualify, each crew had to complete six of the nine scheduled radar bombing runs and two of the three celestial navigation legs. Visual reference was prohibited during the bombing runs which had to be made entirely by radar, and umpires were carried in the aircraft to see that the rules were observed.

Under normal circumstances take-off positions in the competition are drawn by ballot, but as the fastest aircraft, the Vulcans were sent off first from Pinecastle, followed by the Valiants. A high reliability factor in both aircraft and equipment, as well as good crew discipline and drills were dictated by the tolerance of up to five minutes allowed after scheduled take-off time, before automatic disqualification. Little scope for navigational errors was left for the time on-target, which had an allowance of plus or minus three minutes, with the risk of no score outside these limits.

All the R.A.F. aircraft took off at their scheduled times, and all bombing and navigation runs were well within the limits for scoring. Apart from a few minor difficulties experienced with some electronic equipment in flight, particularly in the Vulcans, the aircraft behaved excellently.

The principal results of the competition were published in our issue of November 15, 1957, but it may be added that, with better luck, Sqn. Ldr. Payne's crew might well have taken one of the top places in the competition. On the second night trip they put up a magnificent performance, jumping from 27th to 11th place in the combined bombing and navigation results. On the final run, very fine astro and bombing results were achieved, except for one of the six radar bomb plots, which kept them in 11th place in the final scores. They were then 51 points behind the winning crew, out of the total of 1,000 which could be awarded.

Equality of Standards

The competition certainly determined that the training, aircraft and equipment of Bomber Command compared favourably with the well-established standards of Strategic Air Command, and these results were achieved over a much shorter period than in the U.S.A.F. Future competitions might provide a firmer assessment in terms of results, after the R.A.F. has had time to settle down with its equipment. What would be most interesting would be to observe the performance of SAC crews from the United States in a similar competition in the United Kingdom.

Apart from the training value of the Pinecastle exercise for the R.A.F., however, it enabled the American people to be shown, through Press, newsreel and TV coverage, that Britain is making a positive contribution to the Western nuclear deterrent policy. That such a demonstration is necessary was illustrated by the fact that Union Jacks had to be painted on the aircraft, since R.A.F. roundels conveyed nothing to the average American. The sight of the Valiants and Vulcans and Comets of the R.A.F. contingent in the United States was of enormous educational value, especially to those Americans who may still have judged the state of Bomber Command from the Lincolns and Washingtons which represented it in the SAC Competitions of 1951 and 1952.—J.E.F.

Photograph copyright "The Aeroplane"

PINECASTLE CONTINGENT.— Seen at Marham with the A.O.C. of No. 3 Group, Bomber Command, Air Vice-Marshal K. B. B. Cross, are the Valiant crews who competed in the SAC bombing competition towards the end of last year. On the left is Sqn. Ldr. Payne's crew, from No. 214 Squadron, while on the right is Flt. Lt. Mather and his crew from No. 138 Squadron.

Biggin Becomes Non-operational

Left, Air Chief Marshal Sir Thomas Pike, A.O.C.-in-C., Fighter Command, gives the address at R.A.F. Biggin Hill on January 16. At the bottom of the page are seen four of No. 41 Squadron's Hawker Hunter F.5s, which are being placed in reserve.

Photographs copyright "The Aeroplane"

IN the first of what will, sadly enough, become increasingly familiar ceremonies, the Standard of No. 41 Squadron was handed over to No. 141 Sqn. on January 16, to mark the end of R.A.F. Biggin Hill as an operational station. No. 41 Squadron (Sqn. Ldr. J. Castagnola, D.S.O., D.F.C.), which was equipped with Hawker Hunter 5s, is now disbanded, but its number and Standard have been taken over by No. 141 Squadron (Wg. Cdr. J. W. J. Leggett). This is equipped with Gloster Javelin all-weather fighters, and is based at Coltishall, Norfolk.

The transfer marked the end of an era for Biggin Hill, which was one of the best-known fighter stations in Southern England, largely because of its proximity and location to London. From March 1, it reverts from Fighter to Home Command. Communications flying for the R.A.F. will continue from there, however, and the London University Air Squadron will remain at Biggin. Its change to non-operational status will be followed by the closure of other Fighter Command bases, including North Weald, Tangmere, and others of similar fame.

As Air Chief Marshal Sir Thomas Pike, A.O.C.-in-C. Fighter Command, pointed out at the transfer ceremony, the number of fighter squadrons is being reduced under the terms of the 1957 White Paper, and several stations will therefore become non-operational or be closed. Initially, these will be day fighter airfields in the South, which do not face the main threat from the East; with runways incapable of extension to operate the English Electric P.1; or situated too far inland. In the case of Biggin Hill, there is an additional complication for fighter use, in that it is near the centre of the London airways complex.

Air Chief Marshal Pike was glad to be able to say that although many day fighter squadrons were being disbanded, the Air Council had decided that the numbers of all those famous units which had been awarded Standards, after 25 years of operation, would be transferred to Javelin, and then P.1 squadrons. This meant that they would continue in existence, to uphold the fine traditions of the R.A.F. for "an indefinite period." Fighter Command was an effective part of the deterrent, and contrary to some newspaper reports, it was not going to be allowed to fade away.

Parade Commander at the transfer was the O.C. Biggin Hill, Wg. Cdr. P. D. Thompson, D.F.C., who was a Battle of Britain pilot, as was Gp. Capt. Jamie Rankin, D.S.O., D.F.C., who attended from Fighter Command. He had operated from Biggin at the height of the Battle, in 1940.

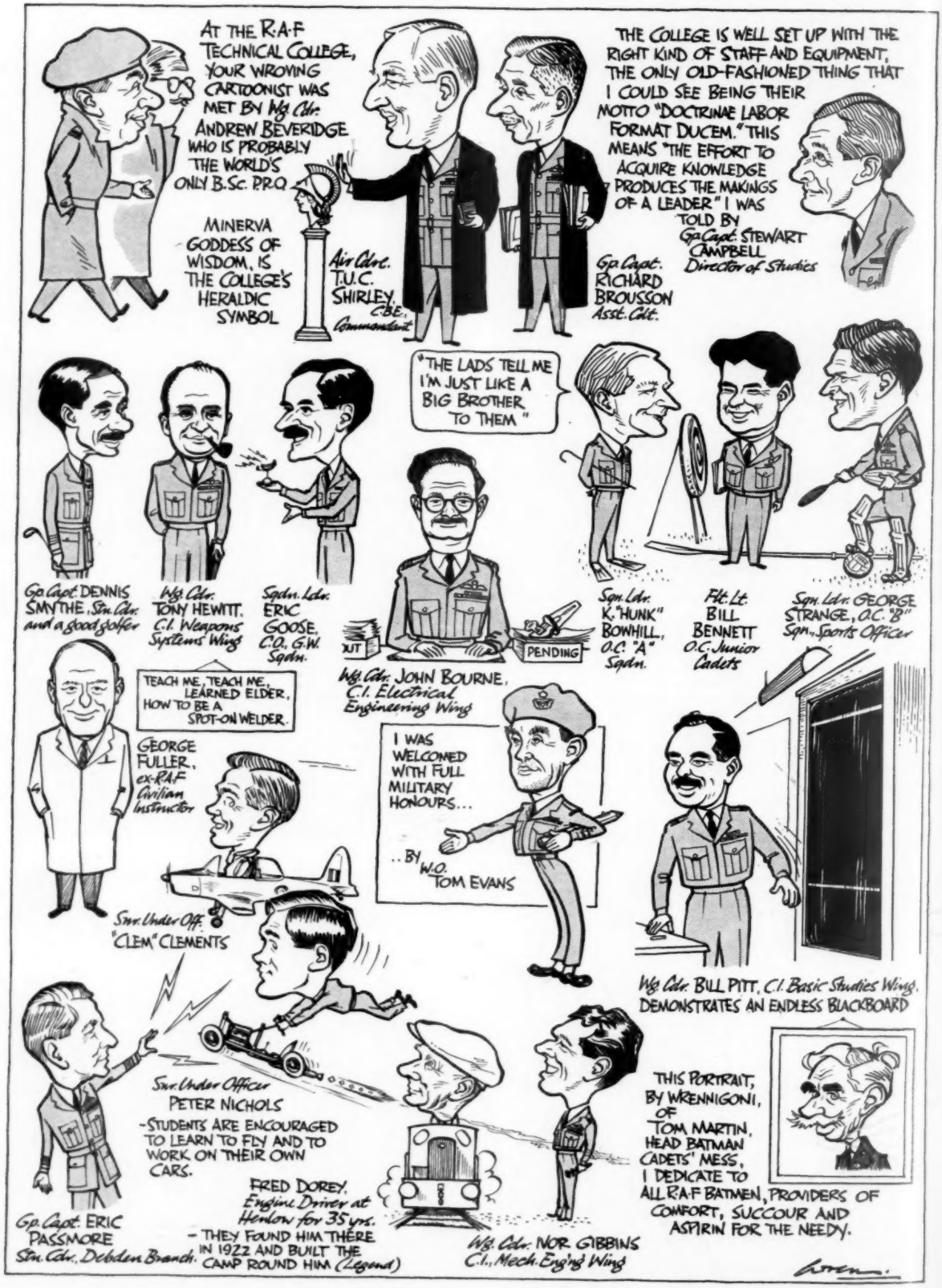
Left, No. 41 Squadron's Standard arrives at the parade. In the picture above it has just been handed over to No. 141 Squadron and, below, is leaving the parade ground.

A reminder of that epic phase in R.A.F. history was conveyed by the single Hurricane and the three Spitfires of the Battle of Britain Flight, which were lined up behind the parade. These aircraft, which are the last airworthy examples of their type in the R.A.F., are to be transferred to North Weald in the near future, and will then go to Martlesham when the Essex station closes.

It was unfortunate that fog prevented these veterans from flying past at the transfer ceremony, and also grounded the Hunters, which were to have pattern-flown the Cross of Lorraine, the centre-piece of the No. 41 Squadron badge. Because of the weather, the Javelins of the new 41 Squadron were also unable to get to Biggin, on this rather sad occasion.—J.E.F.

Above, Air Chief Marshal Sir Thomas Pike takes the salute at the march past during the handing-over ceremony of the No. 41 Squadron Standard.

WROUNDABOUT HENLOW


AT THE R.A.F TECHNICAL COLLEGE, YOUR WROVING CARTOONIST WAS MET BY Wg. Cdr. ANDREW BEVERIDGE WHO IS PROBABLY THE WORLD'S ONLY B.Sc. P.R.O.
MINERVA GODDESS OF WISDOM, IS THE COLLEGE'S HERALDIC SYMBOL
Air Cdre. T.U.C. SHIRLEY, C.B.E., Commandant
THE COLLEGE IS WELL SET UP WITH THE RIGHT KIND OF STAFF AND EQUIPMENT, THE ONLY OLD-FASHIONED THING THAT I COULD SEE BEING THEIR MOTTO "DOCTRINAE LABOR FORMAT DUCEM." THIS MEANS "THE EFFORT TO ACQUIRE KNOWLEDGE PRODUCES THE MAKINGS OF A LEADER." I WAS TOLD BY Gp Capt. STEWART CAMPBELL Director of Studies
Gp Capt. RICHARD BROUSSON Asst. Cdt.
"THE LADS TELL ME I'M JUST LIKE A BIG BROTHER TO THEM"
Gp Capt. DENNIS SMYTHE, Stn. Cdr. and a good golfer
Wg Cdr. TONY HEWITT, C.I. Weapons Systems Wing
Sqdn. Ldr. ERIC GOOSE, C.O. G.W. Sqdn.
OUT
PENDING
Wg Cdr. JOHN BOURNE, C.I. Electrical Engineering Wing
Sqn. Ldr. K. "HUNK" BOWHILL, O.C. "A" Sqdn.
Flt. Lt. BILL BENNETT O.C. Junior Cadets
Sqn. Ldr. GEORGE STRANGE, O.C. "B" Sqn., Sports Officer
TEACH ME, TEACH ME, LEARNED ELDER, HOW TO BE A SPOT-ON WELDER.
GEORGE FULLER, ex-R.A.F. Civilian Instructor
I WAS WELCOMED WITH FULL MILITARY HONOURS...
..BY W.O. TOM EVANS
Wg Cdr. BILL PITT, C.I. Basic Studies Wing, DEMONSTRATES AN ENDLESS BLACKBOARD
Snr. Under Off. "CLEM" CLEMENTS
Snr. Under Officer PETER NICHOLS
-STUDENTS ARE ENCOURAGED TO LEARN TO FLY AND TO WORK ON THEIR OWN CARS.
FRED DOREY, Engine Driver at Henlow for 35 yrs.
- THEY FOUND HIM THERE IN 1922 AND BUILT THE CAMP ROUND HIM (Legend)
Gp Capt. ERIC PASSMORE Stn. Cdr., Debden Branch
Wg Cdr. NOR. GIBBINS C.I., Mech. Eng'ng Wing
THIS PORTRAIT, BY WRENNIGONI, OF TOM MARTIN, HEAD BATMAN CADETS' MESS, I DEDICATE TO ALL R.A.F BATMEN, PROVIDERS OF COMFORT, SUCCOUR AND ASPIRIN FOR THE NEEDY.

From the Lecture Room

Gas Turbines and the Future

Mr. A. A. Lombard, F.R.Ae.S., chief engineer of Rolls-Royce's Aero Division.

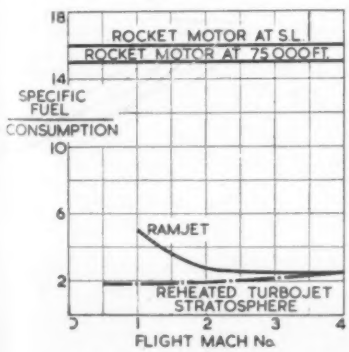
OF ALL the aero-engine manufacturers in the World none stands higher than Rolls-Royce, Ltd. Therefore the lecture by Mr. A. A. Lombard, F.R.Ae.S., chief engineer of the Aero Division of that company, was looked forward to with great interest. Mr. Lombard's paper, "Thinking About Aircraft Engines," was read as a main lecture before the Leicester branch of the Royal Aeronautical Society on January 15.

There are various ways, the lecturer said, in which the thrust of the jet engine may be augmented in supersonic flight. The efficiency of the air intake makes a very significant contribution to thrust at high speeds and further volumetric expansion of the gas products after passing through the turbine by reheating results in 100% thrust increase at M=2.5. As the intake temperature rises with forward speed it is aerodynamically permissible to speed up the compressor to restore a sensibly constant incident Mach number on the blading and this results in more air flow, and thereby increased thrust with a better matching of the intake flow characteristics; this produces a further 66% increase in thrust minus drag. Increase in ram compression with higher forward speed means an increase in expansion ratio across the propelling nozzle well beyond the "choke" point. Without affecting pressure conditions ahead of the "choked" throat it is possible to expand the gas further in a divergent passage and obtain a further increase in thrust. The net result is that at a flight Mach number of 2.7 the thrust is approximately three times that at M=1.

Looking at fuel consumption, better expressed as overall thermal efficiency, it can be seen that the peak efficiency is approximately 28½% at a flight Mach number of 3, as compared to 12% at M = 1. This is the value for a reheated engine; without reheat the thermal efficiency is around 38%.

This picture is given to show that the jet engine, particularly for military applications, is at its best at speeds of over M = 2.5 and for performance is still attractive at M = 3. This is generally well known but we are still a few years away from its practical demonstration.

If this development in performance is possible, what is the problem of application? It can be shown that at M = 3 at 60,000 ft. the engine-intake pressure is identical to that at M = 1 sea level. There will therefore be no pressure problem structurally or thermodynamically.



Specific fuel consumption and speed.

The engine-intake temperature does provide an embarrassment and any speed above M=1.7 in the stratosphere makes temperature conditions worse than M=1 at sea level. At M = 3 at 60,000 ft. the intake temperature is around 350° C. and, although for a limiting turbine-inlet temperature the temperature rise in the combustion chamber has to be correspondingly reduced, when reheated to the same final gas temperature as a ramjet the performance of the jet is still superior. The mechanical problems of the jet engine at this intake temperature become very great and weight an embarrassment.

As the flight speed is increased so does the compression at the air intake and examination shows that for optimum performance the mechanical compression has to be reduced. For a reheated jet engine the importance of mechanical compression reduces with forward speed, and above a flight Mach number of 2.5 there is little to choose, the values becoming equal at a Mach number of 3. Using identical assumptions, the ramjet gives equal thrust per pound of air flow to that of a jet engine at a flight Mach number of 3.7. Looking at the variations of specific fuel consumption against flight speed it is apparent that the jet engine holds its superiority to above M = 3.

But thrust per unit air flow and specific consumption only tell part of the story. Powerplant weight becomes important, more so at high power outputs, high altitudes and high speeds. If one considers the weight of the engine and its fuel for various values of flight duration, the significant conclusion is that although the reheated jet is superior at speeds of the order of M=2.5 at 50,000 ft., the ramjet is well and truly superior at greater speeds and height. These conditions are for sustained flight: accelerating to these conditions will handicap the ramjet. At these heights the superiority of the rocket motor is only for short periods of a minute or so.

However, the ramjet would be handicapped by its boost requirement and many ways have been examined which would deal with this phase. The ducted jet engine combines the good characteristics of the reheated jet for low speed and the ramjet with its high power/weight ratio for high speed.

The turborocket is a means of combining a rocket motor, a jet engine and a ramjet. The rocket motor propellent decomposes and drives a turbine connected to a low-pressure fan, fuel-rich exhaust products from the turbine mix with the fan air, and burn. At very high speeds the fan is allowed to run free and the engine works directly as a ramjet. As both the ducted-jet engine and the turborocket are basically ramjets when operating at high-speed cruise conditions, their characteristics will be similar to those of a ramjet. They differ only in climb and acceleration so that the system operating at the highest exhaust temperature and expansion ratio during this phase will have an advantage in the time required to attain cruising speed and height, and in weight of fuel.

Considering engines for commercial transport aircraft at 450 m.p.h. in the stratosphere for various values of pressure-ratio and turbine-inlet temperature, there is a significant fall in fuel consumption even up to very high pressure-ratios (particularly at higher turbine-inlet temperatures), but beyond a certain value this is offset by an increase in specific weight. There will be an optimum value of pressure-ratio, depending upon range. At 1-hr. flight duration the two parameters are equally important, at 8-hr. duration specific fuel consumption is approximately four times as important as specific weight.

By-pass Potentialities

The by-pass jet is superior at all ranges at flight speeds above 450 m.p.h. Because it is less complicated than the turboprop, safer and quieter for passengers, the jet will always be used for ranges of the order of 500 miles or more. However, where speed is not a paramount requirement, e.g., the transport of freight, the turboprop will always be used.

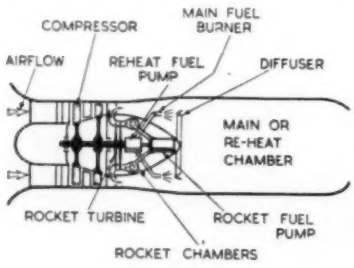
Why was a by-pass engine compared with a turboprop and not a straight jet? It can be shown that specific weight and fuel consumption fall with increase in by-pass ratio until about 0.4, when the specific weight begins to rise. Again, there will be an optimum value depending upon flight endurance but at no point does it equal zero (zero by-pass ratio corresponds with a straight jet). For a transatlantic range, specific consumption is about four times as important as specific weight, therefore where the slope of the specific weight curve is four times as steep as that of consumption this is approximately the optimum value—a by-pass ratio of about 0.7. If each value of by-pass ratio were penalized according to the degree of noise-suppression required, the optimum value would be even higher. The increasing by-pass ratio will, however, demand a large nacelle and this additional drag needs to be taken into account.

Looking at the effect of varying compression ratios, it is again obvious that there is an optimum value depending upon range. For the assumptions used it would appear that a pressure ratio of around 15 is required for long range and over 12 for 1-hr. flight duration.

For high subsonic-speed long-range operation, a high pressure-ratio by-pass engine operating at high temperature for take-off is essential. It is worth emphasizing the need to develop high take-off thrusts even under conditions of high ambient temperature and high aerodromes since this may influence operating economics in an overriding manner; the extra degree of freedom of a by-pass engine is capable of being exploited to this end, and the ability to operate at high combustion temperatures is essential.

For short- to medium-range jet

transport operation an engine employing a high pressure-ratio and high by-pass ratio is also required. The reserve fuel allowances in this type of operation may be as large as the amount consumed during flight. The ability to land,



Turborocket engine.

exchange passengers and take off for the next flight without refuelling is another requirement which dictates low consumption. This is likely to be the engine type for the new short- to medium-range jet transport.

The big step beyond this, particularly for short range, is the more complete integration of the turbine engine and aircraft, and the possibilities of the jet flap and other such lift augmentation devices will be employed.

The high power/weight ratio of modern gas-turbine engines is essential for the development of aircraft vertical or short take-off and landing characteristics, with acceptable economy of operation and satisfactory engine-out performance. Large quantities of air are available in turbojet engines and may be used to increase lift and reduce drag.

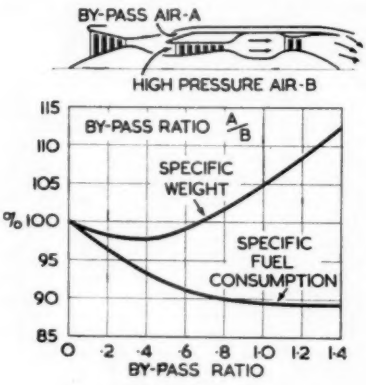
If the volume of high-velocity gas of a turbojet could be used efficiently to augment lift it will then be possible to combine simplicity, comfort, safety and speed with a high percentage payload and a capability for operating out of small aerodromes in any ambient conditions.

The jet flap requires very large quantities of air, preferably the entire mass flow of each jet engine ejecting at the trailing edge of the wing. This air flow could be increased by employing the by-pass principle and the resultant lower jet temperature would be more suitable for ducting within the wing structure.

There is a problem in distributing the jet exhaust along the wing trailing edge. For the high-lift case the jet sheet could be deflected by a small trailing-edge flap.

Lift can be increased by control of the boundary layer, by suction applied either near the leading edge or near the flap hinge-line. The boundary layer may be controlled by suction through slots or porous surfaces, or by energizing it by blowing high-pressure air. Blowing over the flap surface—the Attinello flap—is the most practical method, but is less economical in air requirements.

With the near arrival of long-range high-speed commercial jet transport, the next development could go two ways—towards greater economy at existing speeds or, alternatively, towards supersonic cruising speeds at present costs. The former may be achieved by boundary-layer control—the turbojet



Relationship between weight and consumption and by-pass ratio.

makes this possible—but it would need to be a special engine design to match these conditions.

If we look now at the overall thermal efficiency of the jet engine (without reheat) it is seen that this increases to the impressive figure of 38% at a flight Mach number of 2.5. If an economic value of lift/drag ratio could be achieved at these speeds, long-range flights at this speed will become feasible.

Nuclear Power for Aircraft

When considering the type of reactor suitable for aircraft the overriding requirement is for low powerplant weight, and a high temperature is essential. This indicates two likely systems: (a) a high-temperature direct air-cooled reactor; and (b) liquid-metal-cooled fast reactor.

The thermal reactor, in which fission is caused by neutrons slowed down by a moderator until approximately in thermal equilibrium with their surroundings, may be ruled out due to the large physical size of the fully moderate core, although some degree of moderation may be beneficial to the other types also.

The reactor temperature limitation depends upon the cladding material of the element, not the nuclear fuel, which can be available in ceramic or cermet form. The radiation field from the reactor is well known. If it were practical to put as much shielding on the airborne as on the land-based reactor we could reduce the radiation leak to a negligible amount, but the shield weight would be prohibitive. Dividing the shielding between the reactor and the crew compartment in such a fashion as to result in minimum shielding weight may reduce it to an acceptable value. Even when every conceivable step has been taken the manned nuclear aircraft is still a very large machine. This is based on very optimistic values. In this respect, the unmanned aircraft is technically a more attractive proposition.

Another difficulty is the heavy mass concentration at the centre of the aircraft. The engines will be close to the reactor to reduce heat and pressure losses. The combined weight of the powerplant and shielding (probably around 100,000 lb.) may be over 50% of the weight of the aircraft, and some four times as dense as normal equipment. It prevents relief of structural bending stresses which is used by distributing the weight of conventional powerplants and fuel loads.

A nuclear-powered aircraft is possible and may be demonstrated within the foreseeable future as a military scientific achievement. As a practical military aircraft fulfilling a need incapable of fulfilment in a better manner by other means, it is some distance away. As a commercial transport, and at the present state of knowledge, it can be ruled out.

Discussing the Lombard Lecture

FOLLOWING the lecture, the chairman, DR. E. S. MOULT (de Havilland Engines) opened the discussion by calling first upon MR. A. V. CLEAVER (Rolls-Royce) for his comments. Mr. Cleaver agreed with Mr. Lombard on the possibilities of the turborocket engine. He felt that the case for it depended upon the need for a vehicle cruising at a Mach number of 3 or 4. It was thermodynamically very interesting.

The duration performance of the pure rocket depended upon altitude. The weight of rocket fuel was, admittedly, considerable, but, due to the high rate of fuel consumption, the aircraft weight dropped rapidly—with beneficial effects on manœuvring—after some time had elapsed, which would be particularly valuable in the case of an interceptor.

Referring to engines used for jet-lift, Mr. Cleaver asked the lecturer whether he was happy about the amount of fuel-reserves required for landing. In view of the past government expenditure for purely military purposes, which had now been drastically reduced, there ought to be some prospect of funds for civil research and development leading to the type of VTOL " delta-fuselage " aircraft propounded by Dr. A. A. Griffith.

Replying, MR. LOMBARD said that the fuel-reserves for landing of a jet-lift aircraft were indeed important, but were reduced considerably (relative to conventional diversion requirements) by the ability of the VTOL aircraft to land much more easily and in a smaller space. A slow descent-rate was attained, height being measured accurately by a radar altimeter.

MR. J. L. EDWARDS (de Havilland Engines) challenged the merits of the by-pass turbojet on the grounds of increased drag and pointed out that for the same thrust and diameter a straight turbojet and a by-pass engine would produce the same noise. He felt that in practice there would be troubles with the combustion system of a by-pass engine operating at a peak cycle temperature of about 1,350° K. Air bled from the engine for blown flaps or boundary-layer control would surely require a higher pressure-ratio which penalized the by-pass.

MR. LOMBARD agreed that the noise was the same for the same size of engine, but averred that the by-pass had higher thermal efficiency and better specific fuel consumption. The higher operating temperature of the by-pass engine did not affect combustion efficiency, only the size and length of the combustion chamber. There was no fundamental problem of providing bleed-air for blown flaps.

There was a " tremendous case " for increasing the operating temperature, since better specific fuel consumption would be achieved with as high a combustion temperature as was possible, consistent with long life of the engine. Shortcomings in the temperature-margin were overcome by cooling and Rolls-Royce engines now had air-cooled turbine blades. The problem was to use as little cooling air as possible.

AERONAUTICAL ENGINEERING

B.E.A. Looks Ahead

With the growing interest in VTOL aircraft and the tremendous benefits to be obtained from their use in civil operation, it is not surprising to find that the B.E.A. engineering team has formulated the sort of specification that might be called for should an airline plan to have such an aircraft. The following extracts are from a provisional set of requirements worked out for a VTOL aircraft for passengers, mail and freight.

IN THE development of air transport the VTOL aircraft can give improved direct communications, between many points now served by conventional aircraft, by eliminating much of the surface travel to and from the airport; it can open up new routes without the need to build new airports or improve existing ones; it can provide a convenient means of feeding major airports with their good frequency of aeroplane services and, in certain conurbations, can supply a link between airports. The practicability of such new and improved services depends on the safety, reliability and cost of the VTOL aircraft available to operate them. It is essential that the level of external noise, blast and atmospheric contamination be acceptable for VTOL operations into and out of built-up areas.

The basic factor affecting operation unit cost (cost/seat mile) is the transport capacity of the aircraft, i.e., seat miles/hour, the product of capacity payload and block speed. Past and recent experience in civil air transport operations shows that during the life of an aircraft, type and development of traffic and the operation of other factors are constantly pressing on unit aircraft capacity. This pressure is reflected in the steady increase, seen all over the World, in payload capacity of transport aircraft, for specific routes and route systems. Hence, the largest payload capacity, and size of VTOL aircraft, which is generally agreed to be within the competence of existing design knowledge is specified. This line of approach leads to the broad definition of an initial design payload and "developed" payload. Thus the design initial capacity should not be less than 40 seats over a 200 n.m. stage with a standard seating arrangement. The ultimate development should be capable of accommodating at least 50 seats over a 200 n.m. stage. A statement is required from the designer of the factors which would make this a reasonable expectation.

This aircraft is to be designed to concepts of airworthiness equivalent to B.C.A.R. Group A. De-icing or anti-icing and handling qualities at all flight speeds, which do not impose excessive demands on the pilot in the worst meteorological conditions, are required. Particular attention must be paid to the design and manufacture of all parts subjected to fluctuating loads, which must be proven by rig tests before the aircraft enters into service, and which are continued during the service life of the aircraft.

Performance

The performance required under normal and one-engine-inoperative conditions is given in this section. Unless otherwise stated, maximum take-off weight and ISA+10° C. and 80% relative humidity conditions are to be assumed. All performance is outside the ground cushion.

The payload shall be made up of passengers and associated baggage at 200 lb./passenger, together with a passenger service allowance of 10 lb./passenger.

The fuel load for any stage is to be calculated on the engine manufacturer's stated fuel consumption +3% at the power output required on climb, descent and at cruise altitude at the average cruising speed together with the following reserves: (a) Fuel needed for an overshoot and climb to 1,000 ft. and second landing; and (b) the fuel required at the minimum power for level flight for 60 min duration. (*N.B.* this reserve is for hold-off and diversion.) Tankage shall be provided for stages of up to 300 statute miles' length in a 40-knot head wind with reserves and allowances (a) and (b).

The cruising speed should not be less than 300 knots under the following conditions: (a) Engines operating at the manufacturer's recommended cruise power; (b) the aircraft at 95% of the maximum take-off weight.

The vertical rate of climb at sea-level and maximum continuous or 1-hr. rating of all engines shall not be less than 600 ft./min., without ground effect, and at zero forward air speed. The hovering ceiling without ground effect and with maximum continuous or 1-hr. rating of all engines shall be at least 5,000 ft.

With the critical engine or engines inoperative and the remaining engine(s) operating at the maximum continuous or 1-hr. rating, the rate of climb at the best forward speed for climb shall be not less than 150 ft./min. at all altitudes between sea-level and 5,000 ft. and the gradient of climb not less than 2.5%.

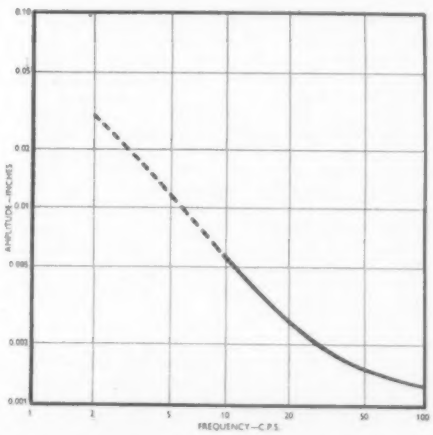
The VTOL aircraft should be capable of operation out of and into sites of limited dimensions closely surrounded by obstructions. The characteristics of such a site may be taken as those described in the report of the second IATA Helicopter Meeting (Brussels, 1955).

In the event of failure of the critical engine or engines at any stage of the take-off from the site described above it shall be possible to return safely to the take-off area or continue flight and land elsewhere.

It shall be possible without requiring exceptional pilot skill to approach and land in a crosswind at least equal to the minimum level flight speed of the aircraft with the critical engine or engines inoperative and the remaining engine(s) delivering maximum or emergency power.

The pilot's view shall be adequate for approach to the landing site in limiting weather conditions (when light patterns on the surface of the landing site must be clearly seen) at all angles of the approach path up to at least 30° to the horizontal. A direct vision opening shall be provided, so that the pilot when using it can make a steep approach and landing without moving his position excessively or in such a way as to make his control of the aircraft unsatisfactory.

[Here, B.E.A.'s note explains that the requirements relating to engine-out rate of climb and crosswind approach and landing, and pilot's view, together with the handling requirements, should permit fulfilment of an engine-out take-off and landing operating from the site described if a "substantially upward" take-off technique is employed. The note goes on: "However, at larger sites an aeroplane-type take-off may be possible. The designer is asked to submit estimates of emergency distance, take-off, distance after critical engine failure and climb-out gradient for different weight, altitude and temperature, and for different speeds at which the engine fails; in estimating emergency distance, a delay of 2 sec. between engine failure and initiation

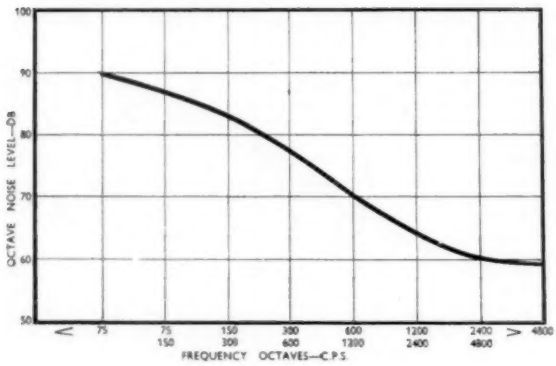


Acceptable vibration on structure in cabin and cockpit.

of action to discontinue take-off should be allowed. To take advantage of landing-site situations alongside waterways, the ability to land on water in emergency and to fly off under its own power is desirable; an estimate of the penalties associated with this property should be given."]

Handling

Experience in helicopter operations to the present time has emphasized the need for greatly improved handling characteristics in instrument flight, which will be a regular feature of scheduled operations. The essential need, when using restricted sites for steep flight paths at low forward speed in landing and take-off, is for good flying qualities under these conditions, both



Acceptable noise level in cabin and cockpit.

under full power and in the event of engine failure. Further, operation into small sites closely surrounded by obstructions will, in gusty conditions, demand good co-ordination of control and crisp response.

The C.A.R. (Sections 6.120 to 6.123) and B.C.A.R. (Section G, paras. 2-6 to 2-10) lay down minimum requirements to be met by rotor-craft, and should where appropriate be fulfilled by VTOL aircraft. In addition, the following requirements should in general be satisfied:—

The stick-free manœuvre margin should be positive for all loadings, and for speeds from the minimum power speed to the maximum speed of the aircraft, i.e., when the aircraft is trimmed at any flight speed a rearward force on the control column (of about 15 lb. per applied g) should be necessary for manœuvres.

The pull-up characteristics in forward flight at all speeds from the minimum power speed to the maximum speed should be free from *stick fixed* divergence as shown by the following test:—

When the longitudinal control stick or equivalent control is suddenly displaced rearward by about 1 in. from trim at the appropriate speed and held fixed at this displacement, the time history of normal acceleration n should meet the following requirements: (a) The accelerations should increase smoothly and continuously to a maximum value and then decrease to the datum level; (b) the curve of acceleration against time should become concave towards the time axis (i.e., d^2n/dt^2 negative) within not more than 2 sec. from the start of the manœuvre; (c) within 10 sec. from the start of the stick displacement and also within 10 sec. from the initial return to the datum value, the normal acceleration should not differ from the datum value by more than $\frac{1}{4}$-g.

It is important that the build-up of acceleration should be smooth, since any irregularities make it difficult for the pilot to anticipate the final result of his control movement.

Response to control about all three axes should be effectively instantaneous, i.e., a time history of aircraft movement following a control movement should show no unacceptable lag in response over the whole speed range. The friction in the controls should be low and the force to overcome static friction (with power assistance to controls in operation, where fitted) should not exceed the following amounts: Lateral, 1½ lb.; longitudinal, 3 lb.; directional, 6lb. All controls should possess self-centring tendencies to the trimmed position.

The above requirements shall if possible be met without the use of autostabilization. In addition, it shall be possible without demanding undue skill from the pilot to fly on instruments at all speeds between the maximum for rearward flight to the design cruise speed; for this purpose autostabilization is permissible.

With autostabilization inoperative a more limited instrument flight envelope is permissible. This shall not be less than from the minimum power speed to the design cruise speed.

If power-assisted controls are installed they shall be duplicated and manual reversion shall be possible. After manual reversion the aircraft shall be flyable in visual conditions at all speeds from the maximum for rearward flight to 80% of the design cruise speed, and on instruments at all speeds between the minimum power speed and 80% of the design cruise speed.

In the event of complete dependence on autostabilization the integrity of the system shall be comparable to the control system of a conventional aircraft.

Operational Features

Loading of passengers for all numbers up to the design seating capacity of the aircraft shall be possible, subject only to a reasonable loading condition (e.g., the forward or rear half of the cabin shall not contain less than one quarter of the passengers carried). All reasonable fuel loadings must be taken into account.

The cockpit layout shall be for two pilots with full dual control. It shall be possible for the aircraft to be operated from one seat; while starting and stopping, an additional person (not necessarily a pilot) may be needed.

Requisite instruments to be provided in both pilots' positions and shall be sufficient for meeting the instrument flight speed ranges. An integrated autopilot flight system shall be installed. In addition, it shall be demonstrated that the information offered by the instrument panel is sufficient for a normally skilful pilot to maintain control of the aircraft while forward speed is increased from zero to the minimum for steady forward flight without autostabilization and while power is increased to the maximum continuous or 1-hr. rating.

Navigational aids shall consist of: a primary aid with pictorial display; a secondary aid, or duplicate primary aid, and instrument landing/system receiver(s). A weight provision of 500 lb. for communications and navigation equipment shall be allowed, together with appropriate space provision.

Ground Handling

The undercarriage shall be so designed that the aircraft can be manœuvred into any desired position with no point of the aircraft passing outside an area 400 ft. by 200 ft. It shall be possible to move the aircraft with a single tractor which is rigidly connected to the aircraft, and the manœuvring required shall not be excessively protracted.

A means of rapidly stopping the rotors which does not require heavy maintenance shall be provided. Means shall be provided to prevent " blade-sailing " while starting or stopping the rotor in steady or gusty winds up to 50 knots. When required by the operator, it shall be possible to provide means for rapidly folding any fixed surfaces to facilitate parking in confined spaces.

The time from tanker in position to tanker away, employing the normal means of refuelling, shall not exceed 5 min. when the tanks are completely filled, while in off-loading fuel the time taken to remove 10% of the fuel capacity shall not exceed 3 min. Pressure refuelling is required, together with alternative means of " gravity " refuelling not requiring special equipment. The pressure-refuelling point shall be directly accessible from the ground. Improved-accuracy fuel gauges are required.

The principal passenger door shall not be less than 2 ft. 6 in. by 5 ft. 6 in. high. Airstairs are required.

Air Conditioning

Pressurization is required so that cabin altitude does not exceed 8,000 ft. and rates of change of cabin altitude do not exceed 300 ft./min. At least 2 lb./min. of fresh air per seat is required for passengers and crew at all heights. Cockpit and cabin temperatures should be separately controlled by the supply of warm air which shall be sufficient to maintain an internal temperature of 70° F. in all operating conditions. Heat generated by radio gear must be dissipated by adequate ventilation. Velocities from warm-air diffusers shall not exceed 40 ft./min. The temperature at head level shall be less than at floor level, and the variation in temperature along the cabin at a given height above the floor should not normally exceed 3° F. Individual control of cold-air supply should be possible and the maximum velocity of efflux in cruising flights should be not less than 300 ft./min.

At a distance of 200 ft. the overall noise level during landing or take-off should not exceed 90 db above 2×10^{-4} dynes/cm.^{2}

The payload accommodation should be so designed that freight can be carried in the whole part of the cabin without damage to furnishings. This will require either (a) that seats can be folded up against the wall, or (b) that seats can be removed rapidly, furnishings being protected from damage by freight, etc., during loading by readily removable panels.

The freight/mail/registered-baggage compartment shall have a minimum usable gross volume of at least 6 cu. ft. per seat of the standard layout and by means of movable bulkheads.

it shall be possible to expand this volume rapidly at the expense of passenger accommodation, provision being made for the protection of furnishings in the portion of the passenger cabin thereby taken into the freight compartment.

Consideration should be given to detachable cargo pods.

The maintenance and overhaul cycle of the aircraft should be pre-determined by the operator in conjunction with the manufacturer and airworthiness authority before the introduction of the aircraft into service, on the basis of representative rig tests on the power transmission system, if any, and on as many other components as is practicable and necessary, together with flight tests conducted by the manufacturer. Components which must be withdrawn for overhaul or examination shall have overhaul or examination lives stated.

The engine overhaul life should be at least 360 flying hours and the transmission system (if applicable) at least 240 flying hours at the commencement of operations with the prospect of rapid increase during the service life to at least 1,000 hr.

The interval between successive maintenance operations, involving the removal of power-transmission components for overhaul lives of such components, shall be multiples of 120 flying hours, i.e., the overhaul lives of such components shall be multiples of 120 flying hours. The ease of removal and replacement of components shall be such that each maintenance operation of this type shall not involve the aircraft in a period of planned unserviceability in excess of 24 working hours. In particular, the time taken to change a power unit shall not exceed 3 hr.

The engines shall be capable of being started from within the cockpit and without external assistance.

Evolution of Space Law

THE legal conundrums raised by the passage of Sputniks, discarded rocket casings and similar man-made jetsam through or over the territorial "air space" of other nations is currently exercising the minds of international jurists. Not, we might add, that it does much good.

Since it is irrational to submit that the sovereignty of a State extends outwards to infinity (as its right to all mineral wealth extends downward to the centre of the earth) and, as it is agreed that free navigation of "outer space" is the prerogative of all, some clear definition of the limit of national sovereignty above the surface of the earth ought to be agreed and ratified. It is just this definition of "How high is the sky?" that has bogged down conference after conference at which it has been brought up. Time and again the question has been conveniently shelved. At the 1956 I.C.A.O. meeting, in Caracas, it reappeared on the agenda but failed to come up despite knowledge of the forthcoming I.G.Y. satellite programme.

Faced now by the Sputnik *accompli* something must be done, and done quickly.

At the American Rocket Society's 12th Annual Meeting in New York, last December, Professor John C. Cooper, former Director of the Institute of International Air Law, and legal adviser to the I.A.T.A., presented a paper on "The Legal and Political Problems of the Russian Satellite." The paper was in two parts; the first being Professor Cooper's able summary of the situation up to the time of the Sputnik launchings. This was followed by a written commentary by Dr. Andrew G. Haley, President of the International Astronautical Federation, and General Counsel of the American Rocket Society.

Professor Cooper said that behind the present difficulties in fixing a "roof on sovereignty" lay certain basic, half-forgotten legal principles. These were:—

(a) The territory of a sovereign State is the area within which it has the right to make its laws effective, to the exclusion of all other States.

(b) As part of that right, the State has full control of transport in its territory, including the determination of what foreign transport instrumentalities may be permitted to enter.

(c) Territory of a State is three-dimensional, including lands and territorial waters within its recognized surface boundaries, *and the "air space" above.*

The prime difficulty is that no international agreement exists as to how far above the surface lies the upper boundary of this three-dimensional national territory. How far upwards is the "roof" and what is meant by "air space"?

At the "International Convention for the Regulation of Aerial Navigation," at Paris in 1919, it was universally recognized that "every Power has complete and exclusive sovereignty over the air space above its territory." The U.S.A. participated in this Convention, but did not ratify it for other reasons. The U.S.S.R. was not represented, though in various statutes it has also declared superjacent air space to be part of its territory, and has forcefully exerted its right to deny the entry of foreign aircraft into its "air space" on more than one occasion.

Such was the situation when scientists of many nations, including the United States and the U.S.S.R. planned the present Geophysical Year. The announcement that, as part of the plan, the United States would launch one or more satellites to collect scientific data was then made without asking formal permission of any other State to project the proposed satellites over such other States. Shortly afterwards the U.S.S.R. disclosed a similar programme, again without formal inter-governmental exchange of flight permits.

From this jurists are taking two different views. Some insist that the United States, by its announcement, had in effect declared that space above the atmosphere was not part of the territory of any State and could be used by any State. Others argued that the failure of any State to object to the proposed Geophysical Year satellite programme was evidence of consent.

Professor Cooper then mentioned that in 1957, prior to the satellite launchings, the United Nations Disarmament Sub-Committee, meeting in London, had defined "outer space" as at a distance beyond the Earth at which "there was no longer friction of air to delay and retard the speed." This seems to support strongly the argument of its sponsors that national sovereignty does not exist in "outer space."

Professor Cooper also reminded the delegates that he had himself previously proposed the need for a Treaty giving subjacent States full sovereignty in the areas of atmospheric space above it up to the height where "aircraft," as now defined, may be operated, such area to be designated "territorial space."

To this he now proposed should be added, tentatively, "Extend the sovereignty of the subjacent State upward to 300 miles, designating this second area as 'contiguous space,' and provide for a right of transit through this zone for all non-military flight instrumentalities, when ascending or descending." Secondly, he proposed, "accept the principle that all space above 'contiguous space' is free for passage of all instrumentalities."

Commenting on Professor Cooper's "memorandum," Dr. Haley said that though he was in agreement with the basic principles he felt he should add some clarifications. At a plenary session of the I.A.F., in Barcelona last October, a unanimous decision was taken to constitute a Special Committee "to define the regime of jurisdiction of air law, and of space law." It was agreed that two Russian scientists should be appointed to the Committee, two from the United States, and the rest from countries such as Great Britain, Germany, France, Italy, and so on.

He then went on to foresee the need for international regulation of point-to-point rocket communications in the future. National jurisdiction would be maintained by the granting of landing and launching rights by the countries concerned. Movement to or from any point on Earth would need national licences and permits. International co-operation and regulation would be essential over intermediate regions because of varying trajectories, altitudes and routes, the need for navigational aids, meteorological services, safety, etc., when manœuvring either in "contiguous space" or outer space.

Mankind, declared Dr. Haley, must mature appreciably to create an international authority having sole and complete jurisdiction over space flight. No single national has a paramount claim to outer space. National sovereignty ends for all purposes with the Karman line (the practical physical termination of air).

Finally, Dr. Haley drew attention to what he described as an authoritative Soviet legal view, extracted from an article entitled "To whom does Outer Space belong?," by A. Shternfel'd, Moscow, 1956. This showed that at least the Soviet Union appreciated the difficulties, though the extract itself could offer nothing more useful than a reiteration of pious hope.

—I. G. WHY.

Astronautics

Data from a Fixed Point in Space

By S. W. Greenwood, B.Sc., M.Eng., A.M.I.Mech.E., A.F.R.Ae.S.*

THE International Geophysical Year has focused interest on the field of upper air research by means of balloons and rockets. The purpose of this note is to attract interest in the possible applications to such research of a type of aircraft which it should be possible to bring into operation during the next decade. It is thought that such an aircraft would form a distinct category of vehicle and this note outlines its characteristics. The aircraft would operate for long periods approximately under a fixed point in space, that is, it would remain substantially at rest relative to the fixed stars while the Earth spins beneath it (Fig. 1).

Possible uses for the vehicle are indicated by a consideration of Fig. 2, which shows how the fraction of the atmosphere above vehicle-altitude decreases as the vehicle-altitude increases. At 60,000 ft., for example, less than 10% of the atmosphere

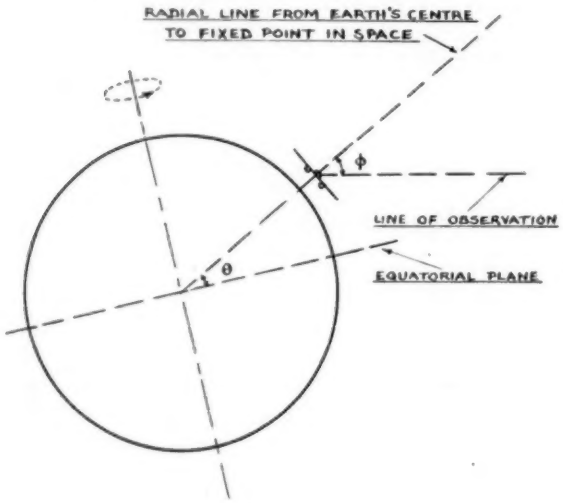


Fig. 1.

lies above the vehicle. Atmospheric turbulence and clouds are contained mainly in the region below 40,000 ft. Fig. 2 is, however, only an indication of the significance of altitude, as some phenomena of great importance occur at higher altitudes.

It is suggested that the uses of the vehicle might include:—

(A) **High-altitude meteorological work**

Meteorological phenomena in a particular region of the atmosphere are influenced by, among other things, (a) the position of the Sun in the sky, and (b) the latitude of the region. A vehicle of the type proposed in this note would operate under fixed conditions of (a) and (b). It would thus continuously supplement the work of ground stations and of intermittent aircraft and rocket flights.(1)

(B) **High-altitude research on cosmic and solar radiation.**

The proposed vehicle would permit research to be carried out under constant conditions of (a) and (b) above. As with (A), the vehicle would continuously supplement existing work. (1) (2) (3). It should be noted that the position of the region in the Earth's magnetic field is an important factor in many of these studies.

(C) **Continuous astronomical observation of a chosen region of the heavens.**

The proposal here is that the vehicle should operate as a platform for continuous astronomical observations from above the cloud-bearing and turbulent lower regions of the

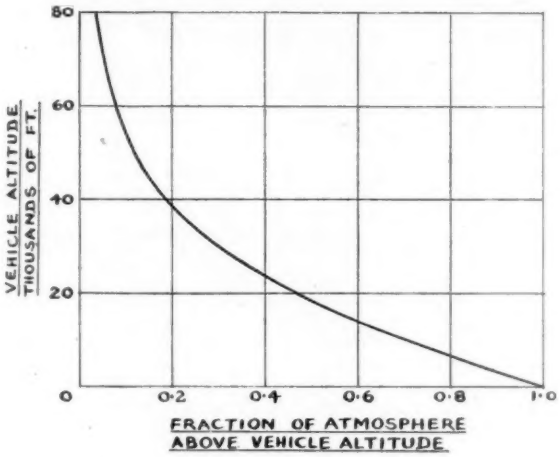


Fig. 2.

atmosphere. Visual observations of an eclipse of the Sun from aircraft were carried out a few years ago, and it is suggested that the logical extension of this is to provide a platform permitting continuous observation of the Sun or of other bodies. In comparison with proposals for an observatory in space, this proposal presents a number of difficulties, in particular the problem of operating a telescope of high resolving power in a high-speed aircraft at low ambient pressures. On the other hand, the long-range high-altitude aircraft may well be a reality before the manned satellite observatory.

(D) **Crew testing and training under confined operating conditions for long periods.**

These problems are already being encountered in a milder degree by crews of long-range military aircraft. The vehicle here proposed would provide experience on crew behaviour under conditions which would correspond in many respects with those which it is anticipated will be encountered in journeys through space.

Work on (A) and (B) above would preferably be carried out by a number of vehicles operating simultaneously under a co-ordinated programme.

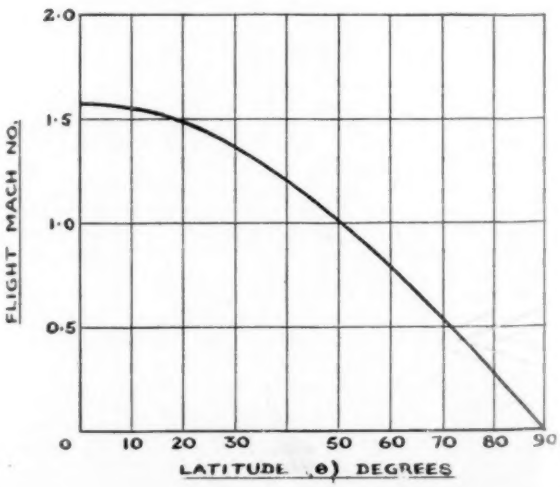


Fig. 3.

* Lecturer in Department of Aircraft Propulsion, The College of Aeronautics, Cranfield.

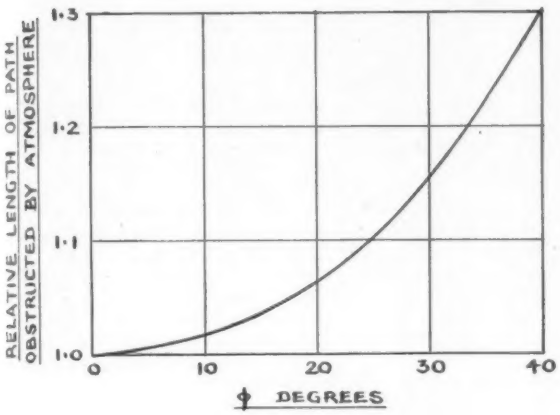


Fig. 4.

The variation of the vehicle Flight Mach No. with latitude in the stratosphere is shown in Fig. 3 (Mach 1 is about 660 m.p.h., in the stratosphere). From the viewpoint of the aircraft operator, the regions of difficulty are probably those close to the Poles where the flight speeds are very low, and the transonic regions between latitudes 40° and 55°. (The United Kingdom lies between latitudes 50° and 60° N.)

Observation along a path that is not a radius through the Earth's centre does not involve a very severe penalty. Fig. 4 shows, for example, that at an angle of 25° to a radius, the length of path obstructed by the atmosphere is only increased by 10%.

It would be of interest to receive the views of physicists and others on the possible uses of such a vehicle.

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Book Reviews

DYNAMIC INSTABILITY. By Y. Rocard, C.B.E. 227 pp. 5½ in. by 8½ in. Illustrated. Crosby Lockwood and Son, Ltd. Price 45s.

IN THIS comprehensive analysis, Professor Rocard, who is Professor in the Faculty of Science at the University of Paris and Director of the Physical Laboratory of the Ecole Normale Supérieure, deals at length with one of the more complex problems of mechanical science. His book, which has been translated from the French by M. L. Meyer—a lecturer in the Postgraduate Department of Applied Mechanics of Sheffield University—covers the whole subject from a simple exposition of the basic theory to advanced application.

This is essentially a book for engineers in general for it deals with automobiles, suspension bridges and aircraft. The last-named are dealt with in two final chapters. The first of these discusses the critical speeds of aircraft wings, covering such things as the elastic energy of a deflected wing, the kinetic energy of an oscillating wing, and the aerodynamic forces acting on an oscillating wing. It also includes notes on the static fracture of aircraft wings and on control reversal. The second "aircraft" chapter deals briefly, but thoroughly, with the mathematics of longitudinal stability relationships.—F.T.M.

THERMAL STRESSES. By B. E. Gatewood. 232 pp., 9 in. by 6 in. Illustrated by diagrams. McGraw-Hill Book Co., Inc. Price 56s. 6d.

IN the past the attitude of many designers and stress calculators to the problem of thermal stresses in aircraft structures has been one of guarded pessimism. The drill went usually as follows: discover by the best means you could the temperatures likely to be encountered, calculate the stress as if such conditions did not exist, equate it to the allowable stress in the metal at the elevated temperature, and leave a bit in hand.

This philosophy—if it merits the description—worked well enough for isolated components and for those portions of the airframe, such as engine ribs, adjacent to a source of heat. But when it was applied wholesale over the entire mass of an aircraft subject to kinetic heating, the weight penalty became disastrous and something more refined had to be done about it.

Professor Gatewood's book on "Thermal Stresses" is therefore timely, for although military aircraft are only beginning to move substantially into the realm of hot structures, and civilian aircraft lag far behind, the guided-missile designer has already got the problem in his lap.

The book is an excellent introduction to thermal stress calculations, moving step by step from simple, fundamental formulæ to an understanding of transient temperature effects and one-dimensional temperature distribution. Thermal stress problems in two dimensions are then dealt with, and there is a further chapter on the procedure for solving the thermal stress equations. The subject is further backed by a chapter on the thermal effects on structural deflections and stiffness.

Naturally there is a chapter devoted entirely to allowable stresses. Probably no topic has intrigued the structural designer so much as the behaviour of metals and alloys as they become hotter and hotter. The literature is extensive, and even the 139 separate references quoted by Prof. Gatewood are but a fraction of the reports made public or hugged in secret. The student would be advised to make his own assessment of the relative efficiency of different materials at elevated temperature, rather than accept the evidence of diagrams given. He may find that practical considerations of manufacture will upset preconceived notions based on allowable stress data supplied under somewhat idealized conditions.

Except for this warning we have nothing but praise for this book.—J.G.S.

GETTING GOING IN CANADA.—Taxi-ing trials of the Avro Aircraft Arrow delta-wing all-weather fighter have now begun at Malton, Ontario. Here [illegible] company's chief test pilot, Jan Zurakowski, gets into the aircraft before taking it out for the first time under its own power.

The Latest Vipers

ORIGINALLY conceived as a short-life engine for the Jindivik target drone, the Armstrong Siddeley Viper has been steadily developed since the A.S.V.2 first ran in April, 1951. In addition to the well-known Viper A.S.V.8 there are now several later developments with higher power, the A.S.V.9, 10 and 11. And there is the Dassault R.7, a scaled-up French derivative.

Starting with the A.S.V.8, this engine powers the Hunting Jet Provost and is of 1,750-lb. thrust. The early units of this type were in fact A.S.V.5s (1,640-lb. thrust) modified to a later standard. For the production Jet Provost T.Mk.2, the version of the A.S.V.8 used is the Mk.102.

This engine has been developed specially for long life in a training aeroplane and differs in detail from earlier Vipers. The vaporizing-type combustion chamber, now similar to that of the Sapphire and Mamba, has been modified to improve temperature distribution upstream of the turbine. This new chamber is now made in several sections so that such parts as vaporizing tubes are separate and can be replaced at engine overhauls.

The Mk.102 has completed a 150-hr. test to the new M.o.S. fighter test schedule, this being chosen by Armstrong Siddeleys as the most severe test yet devised. As an outcome of this the engine has been cleared for operation at take-off rating for 20 min.

An interesting facet of the company's engine development research work is the use of two- and three-dimensional water-analogy methods. In the case of the latest Vipers, a plastic model of the new combustion chamber was made and air bubbled through water to visualize the fluid flow. The benefits of this research have been used on the A.S.V.8, 9, 10, 11 and on the Dassault R.7.

The Viper A.S.V.9 is essentially an uprated A.S.V.8 and has a higher turbine-inlet temperature which increases the sea-level static thrust to 1,900 lb. It is highly probable that this is the Viper used in the Bell X-14, jet-powered flat-riser VTOL aeroplane.

To achieve performance in excess of the A.S.V.8 without increasing the operating temperature, it was obviously necessary to effect some geometrical redesign. Such performance was sought because it was thought that the Jet Provost take-off weight might well be increased by additional military requirements and that take-off from high levels might be specified for certain export possibilities.

It was thus required to redesign the engine for a higher mass-flow without either shortening the life or altering the external dimensions. This was done by decreasing the hub/tip ratio diameter of the front stages of the compressor, the resulting mass-flow being increased by about 30% to 42 lb./sec. of air. The turbine diameter was increased slightly, but was still within the diameter of the A.S.V.8 combustion chamber—the limiting factor for installation in airframes originally fitted with the A.S.V.8.

It was found that it was possible to increase the mass-flow, and, therefore, the thrust, well beyond the 2,000-lb. mark without increasing turbine-inlet temperature beyond that of the A.S.V.8—the peak cycle temperature. So, working back from this thrust value, a lower operating temperature was attained than for the A.S.V.8, the point being that a thrust in excess of requirements would simply give too high a fuel consumption and, in any case, a lower temperature would give even longer life in service. This, then, was the A.S.V.10 produced as a private venture in anticipation of future needs.

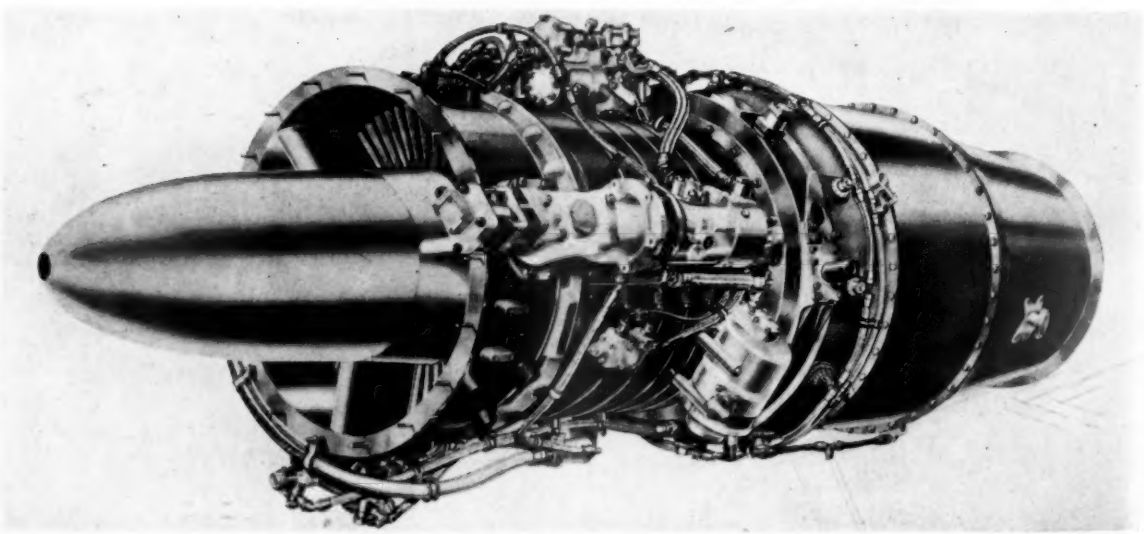
For other applications where higher thrusts are required the A.S.V.11 has been developed and is an uprated A.S.V.10 with a sea-level static thrust of 2,450 lb. Comparative specific fuel consumptions for the A.S.V.8, 9, 10 and 11 of 1,750, 1,900, 2,000 and 2,450-lb. thrust respectively are, 1.12, 1.13, 1.01 and 1.11 lb./lb./hr.

The A.S.V.10 and 11 differ from earlier Vipers in that a new mechanical design of compressor rotor is used, with either fir-tree (first stage) or pin retention (remainder) of the blades instead of the T-slot retention formerly used. The A.S.V.8 Mk.102 and A.S.V.10 accessory drives are mounted at the nose of the engine instead of at the side as with the earlier engines in the Jet Provost.

Overseas interest in the Viper has increased considerably in recent years. Apart from the Jindivik (A.S.V.3), Dassault used the engine in the Mirage I and Sud-Aviation in the Trident I (A.S.V.5). The Macchi MB.326 is flying with one (A.S.V.8) and production versions may well have a later model (A.S.V.10). There is also an Ikarus project from Yugoslavia for a trainer (A.S.V.8).

American interest in the Viper is not confined to the Bell X-14 although no precise details can yet be quoted. It can be said, however, that the Viper may be seen as the powerplant for drones, trainers and similar types of aeroplane. It is not impossible that Vipers might be used in a British twin-engined executive aeroplane for military or civil use.

The A.S.V.100 or R.7 engine built by Marcel Dassault is a scaled-up Viper of 3,000-lb. thrust without afterburning for an s.f.c. of 1.09 lb./lb./hr. An additional 30% thrust is obtained by the use of an afterburner. This engine would be suitable for training aeroplanes requiring a higher thrust than that provided by the smaller Viper, or for the twin-engined installation of a light fighter.



The Armstrong Siddeley A.S.V.10 Viper turbojet.

Comets Pile up the Hours

AT the present time there are 14 D.H. Comets in daily operation. Because most of them are flying with the Royal Air Force people in these islands see them but seldom, though the two in service for training purposes with B.O.A.C. from time to time make known their presence to dwellers around London Airport. In some three months the Corporation has put in 1,500 hours of flying on proving flights with these aircraft in preparation for the advent of the Comet 4s now on order.

In eighteen months the 10 Comet C.2s of the R.A.F., which it will be remembered are modified Comet 2s, with Rolls-Royce Avons, have completed 8,500 hours of flying. In this period they have crossed the Atlantic 78 times and the Pacific 26 times. The weekly return service to Christmas Island, a round trip of 19,000 miles, is done in a flying time of 45 hours. The elapsed time is three days 18 hours.

The R.A.F. Comets have been used to move in emergency 677 sick men, women and children. This total includes six polio cases; for the special equipment needed for their care the aircraft's electrical system has been specially adapted. In all, some 50 million passenger-miles have been achieved by R.A.F. Comets which have been used to carry many thousands of troops.

In the last four months of last year Comets of the Royal Canadian Air Force made a dozen flights across the Atlantic.

Indeed the R.A.F. and R.C.A.F. are operating the only regular military jet airliners in the World. (News about new Comets, p. 104.)

Titanium Technology

TITANIUM is a most topical metal and the means of producing it are interesting even to the non-metallurgist. As one of the oldest (founded in 1774) and largest companies producing steel in this country, William Jessop and Sons, Ltd., of Sheffield, are devoting a large part of their research activities into developing the workshop technology required for the production of titanium.

In addition, new means of producing vacuum-melted steel and zirconium have been investigated. A large vacuum-induction melting furnace is soon to be put into use in the main works as a result of research work into this type of unit.

Jessops now market seven types of titanium and titanium alloy under the " Hylite " trade name. This metal has a natural affinity for oxygen and must be melted in a vacuum because in air the liquid metal quickly reacts to the presence of oxygen and forms titanium oxide.

The Jessop method is to use a double-melting technique which uses an ingot from the first melting as an electrode for the second. By this means—which was perfected at the research department—a homogeneous alloy is produced which typically has a total hydrogen and nitrogen content of about 160 parts in a million.

A vacuum-arc melting process is used to melt titanium because the vacuum-induction method suitable for steel would release oxygen. The basic titanium sponge is formed into small sections which are welded together to form an electrode. The vacuum-arc melting process produces ingots from these electrodes.

For aero-engine applications, " Hylite " 50 titanium alloy is suitable for heavy-duty service as a material for compressor discs or blades. Its density at 20° C. is 0.166 lb./cu. in. and at 600° C. the coefficient of linear thermal expansion is 10.1×10^{-6}°C. with an associated Young's Modulus value of 5,475 tons/sq. in. Maximum hydrogen content is 0.015% and the Brinell hardness number is 350.

A prominent feature of the Whiston Grange research department is the large number of various types of test-rig, many of which are for fatigue and creep-testing under high-temperature conditions.

Titanium is still a fairly expensive material and it is unfortunate that just when the price was beginning to tumble because of increasing usage, the cuts in military expenditure drastically curtailed the requirements. However, Jessops are continuing their work and are seeking all kinds of applications for this most useful material.

A Military Visitor

THE first Douglas C-133A to visit this country landed at the U.S.A.F. Base, Burtonwood, on January 12 after a flight of 10 hr. 28 min. from Dover A.F.B., Delaware. It flew back to Dover via R.C.A.F. station Hermon, Newfoundland, two days later.

The C-133A (A.F. serial 40144) is one of two that are making " operational suitability " trips to various airfields where loading and off-loading facilities are tested. The visit to Burtonwood was the second of such visits to Europe, for a C-133A had visited Chateauroux a few days earlier.

The C-133A that landed at Burtonwood belongs to 39th Air Transport Squadron, M.A.T.S., and was commanded by Capt. R. R. Bern, who previously flew C-97s. About 40,000 lb. of normal freight was carried in each direction.

Capt. Bern said that the trip from the States was made at 23,000 ft. with a tailwind that gave the aircraft a speed of around 500 m.p.h. Normal cruising speed is 311 m.p.h.

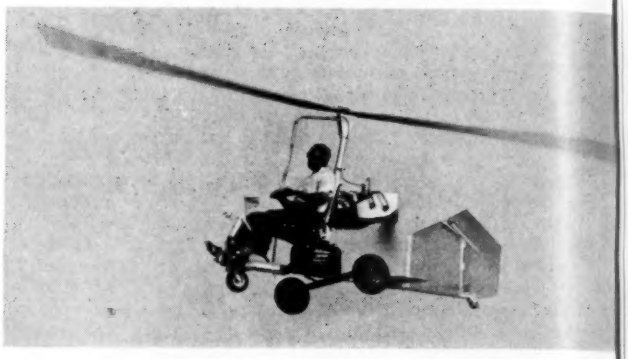
The aircraft handles very similarly to the C-97, said Capt. Bern, and, if anything, the 6,000-h.p. Pratt & Whitney T34-P-3 turboprops made the pilot's job less complicated. The crew numbered 10, although it would normally be six, and included a civilian, Mr. C. D. Bell, of the Douglas company.

The proportions of the C-133A are pleasing and the high wing means a huge hold free from any obstruction. Loading is by means of a ramp under the rear fuselage.

Mr. Bell said 25,800 cu. ft. of the aircraft were pressurized and this space includes 13,000 cu. ft. for cargo. The C-133A carries a maximum of 118,000 lb. of fuel.

Capt. Bern said that in his five months' experience of the C-133A the undercarriage arrangement worked well. The main wheels, which retract into bulges on each side of the fuselage, comprise eight 53-in. diameter wheels in two pairs on each side. The aircraft has a track of 18 ft.—L.C.S.

FIRST ARRIVAL.—The Douglas C-133A military turboprop transport which visited Burtonwood recently.



On the left, and in the bottom left picture, is seen a Bensen Gyro-Copter fitted with a cockpit enclosure and operated by an agricultural company in Florida. In the picture immediately above is shown the prototype Bensen Model B-8M with Igor Bensen at the controls. At the bottom of the page, on the right, is the production Model B-8M, again flown by its designer. This aircraft has a 45-in. Banks-Maxwell propeller of 24-in. pitch.

Howard Levy photographs

A New Bensen Gyro-Copter

THE Bensen Aircraft Co. is now producing a new version of the Gyro-Copter known as the Model B-8M. The craft is basically similar to earlier models but is powered by a more powerful engine, a two-stroke four-cylinder air-cooled McCulloch 4318E developing 72 h.p. at 4,100 r.p.m. Another modification is the addition of a mechanical rotor drive which brings the rotor up to flying speed on the ground, thus reducing its take-off run to less than 50 ft.

The Model B-8M has been demonstrated to the U.S. Army at the Army Aviation Center, Ft. Rucker, Alabama, and, according to the manufacturer, Army observers were particularly interested in its low operating cost of $3-$5 per hour. The craft can be disassembled with a pair of wrenches and transported by jeep or station wagon. Maintenance requirements are almost nil.

According to Igor B. Bensen, president of the company, they have sold plans and kits of the various Bensen designs (B-7 Gyro-Glider, B-7B flying-boat, B-7M Gyro-Copter, B-7W Hydro-Glider, and B-8 Hydro-Glider) in every one of the United States and 73 countries.

Although the new Model B-8M is available in ready-to-fly form to the U.S. military Services and is sold for export at $2,995.00, C.A.A. regulations would not let private U.S. pilots buy and use them in ready-made form. However, they are available to private U.S. buyers in kit form. The Bensen Gyro-Copter has not been type-certificated as C.A.A. regulations require dual-ignition engines, while the McCulloch and previous Nelson engines use single ignition. The Model B-8M has already passed its 100-hr. full-throttle endurance test and is still going strong without any ignition problems. Some 30,000 McCulloch engines were built for the Air Force over a period of 11 years and no ignition breakdowns were ever reported.

The rotor of the B-8M is of laminated plywood with a steel spar designed to a minimum load factor of 9. Aerofoil is a Bensen G2, thickness ratio .012 and chord 7 in. Solidity is .037; normal disc loading 1.59 p.s.f., and rotor speed, 420 r.p.m. Suspension is by means of a " teeter-hinge " without lag hinges.

The fuselage is built of 6063-T6 aluminium tubing with the primary structure assembled with AN-4 bolts. There are no welded, brazed, glued, riveted, or bonded joints in the primary structure.

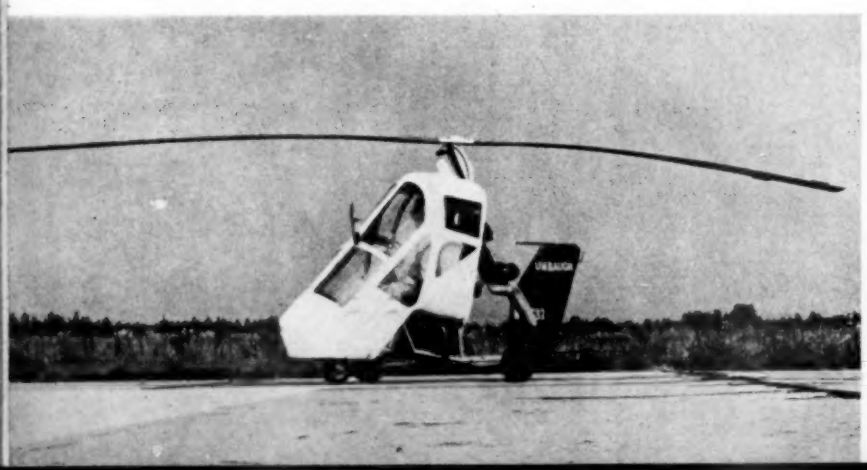
There is no collective-pitch control, but an overhead azimuth stick provides for cyclic control. Rudder and nose-wheel steering takes care of yaw control. The throttle is situated on the left handle-bar and is a twist-grip type. The craft is fitted with brakes in the form of a single unit on the nose-wheel.

Standard equipment consists of an airspeed indicator, 1,000-lb. safety belt, kapok seat cushion, wheel-type landing gear, and a 1,000-lb. capacity tow hook. Optional equipment consists of the rotor-starting drive, altimeter, shoulder harness, and auxiliary fuel tank.

DIMENSIONS.—Rotor diameter, 20 ft.; length (less rotor), 11 ft. 4 in.; width, 5 ft. 6 in.; height, 6 ft. 3 in.; tread, 5 ft.

WEIGHTS.—Empty weight, 247 lb.; useful load, 253 lb.; overload useful load, 353 lb.; normal gross weight, 500 lb.

PERFORMANCE.—Maximum speed, 85 m.p.h.; cruising speed, 60 m.p.h.; minimum level speed, 14 m.p.h.; take-off speed, 18 m.p.h.; landing speed, 7 m.p.h.; maximum economy speed, 45 m.p.h.; take-off run (calm air), 300 ft.; landing roll (calm air), 20 ft.; range, 100 miles; endurance, 1½ hr.; service ceiling, 16,500 ft.; maximum rate of climb, 2,000 ft./min.; minimum rate of descent, 18 ft./sec.; ferry range, 300 miles.—HOWARD LEVY.

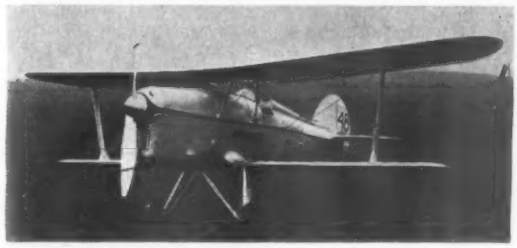


PRIVATE FLYING

H.J.C.'s Club Commentary:

Last Year's Totals

Full C.P.L. Courses



OLD TIMER.—The Arrow Active Mk. II, G-ABVE, of 1932, which is referred to on this page.

● ONE FACTOR contributing to the high total of 3,822 hr. flown by the **Elstree Flying Club** in 1957 has been the use of the Chipmunk aircraft, which is suitable for both elementary and advanced instruction. This total was achieved with seven aircraft; the 1956 total was 3,709 hr. flown on nine aircraft.

At the beginning of this year David Ogilvy became chief instructor of Air Schools, Ltd., which operates the Elstree club; that means that he is administratively responsible for all flying and ground training within the company as a whole, and we are pleased to hear that his new duties will include reviving the **Derby Aero Club,** which has become dormant.

The club's first full-time course for the C.P.L. and Instrument Rating begins on January 28, and Capt. E. Brook-Williams, for many years B.O.A.C.'s superintendent of navigation, has joined to look after the comprehensive syllabus of flying and ground tuition. Advanced and specialized Link training is now in the hands of Brian Garwood and Bert Hazzard, who are Link trainer instructors with B.E.A. The total fees for the C.P.L. course are less than £1,000; the scheduled time for completion of the course is 32 weeks, allowing another six-nine weeks for the Instrument Rating. Most of the flying will be on Chipmunks, but twin-engine conversions will be included. Radio training will be done at Luton Airport, as there are no VHF/DF facilities at Elstree, and the Luton Homer will be operative when night cross-countries are being flown.

The club's course includes full ground tuition, which means that Elstree now ranks with Air Service Training, Ltd., at Hamble, and Airwork, Ltd., at Perth, in this respect, but Elstree's course is primarily for individuals wishing to train and is not for mass training under group contracts.

● BY FLYING 279 hr. 45 min. in December the **Fair Oaks Aero Club** achieved a total of 6,671 hr. for the whole of 1957—which they think is a record for any club in England. Two P.P.L.s were gained during the last month of 1957, by Messrs. Tucker and Evans; and Messrs. Moore and Mountstephen and A.T.C. cadets Headley and Gale flew solo.

It has been agreed with the M.T.C.A. that to reduce aircraft "noise nuisance" to a minimum, the circuit at Fair Oaks be changed every 4 hr. (it might be termed "spreading the load") and members and visiting pilots are specially reminded to look at the signals area on arrival. A further measure to this end is the fitting of long exhaust pipes to the Tiger Moths, and low circuits are becoming taboo.

Doings at Croydon

● AMONG the various aircraft to be seen in Rollason's hangar at Croydon is a Tiger Moth, G-APDZ, which is being modified for aerobatics and will be flown by Mr. C. A. Nepean Bishop during the next season. Instead of the 3½-gal. fuel tank in the front cockpit, plus the standard tank as fitted to his earlier mount, G-ANSH (a description of which we published in our issue of June 7, 1957), the new conversion will have a pump-fed 7-gal. tank only, the normal tank over the centre-section being removed.

WHITE WALTHAM PUPIL. — David Deacon, 17, a pupil at the High Wycombe Royal Grammar School and a member of the C.C.F., has gained his P.P.L. with the West London Aero Club.

Besides operating the oldest British-registered Tiger Moth, G-ACDC, the **Tiger Club** now also has in commission the next oldest, G-ACDJ, which likewise has been rebuilt by Rollasons.

Also at Croydon are the remains of the old Arrow Active II, G-ABVE, an all-metal single-seat biplane, built in 1932 by Arrow Aircraft (Leeds), Ltd. There is not much of it left, but Rollasons hope to rebuild it and eventually get it airworthy. It was powered by a 120-h.p. D.H. Gipsy III engine (later a Hermes IVB) and had a speed of 144 m.p.h. The wing span was 18 ft., the length 18 ft. 10 in., and the Active II weighed 1,325 lb. loaded. Only two Actives were built. The Mk. I was G-ABIX.

A Single-seat Sportsplane

BUILT by Howard L. Terrill, of Torrance, Calif., is this Terrill Special, which has the lines of a typical American midget racer; but it does not qualify for closed-circuit racing as it has a 100-h.p. Lycoming engine which puts it outside the N.A.A. category. It has a Cessna-type spring-leg landing gear, and is credited with a maximum speed of 220 m.p.h.; it cruises at 180 m.p.h. The wing span is 16 ft. 10 in., the length 19 ft., the height 4 ft. 6 in.

We have given up hope of seeing something like this produced in the United Kingdom. While the P.F.A. is successfully encouraging the building of ultra-light types of limited power and performance, aircraft such as the Terrill cost far too much for any individual in Britain to make one and no industrial concern seems to think it worthwhile.

Levy-Enich photograph.

SOARING WEATHER.—This picture of the Sierra Wave at Bishop, California, taken by H. Klieforth, has been sent to us by Dr. R. S. Scorer, who is to present a programme of colour stills of clouds at the Kronfeld Club in London on January 29. There are to be two 35-mm. film-strips, each of about 25 frames.

GLIDING NOTES

NORTH ISLAND is rapidly catching up with South Island in the matter of lee-wave flights in New Zealand, although its chief mountain chain, which is geologically a continuation of the Southern Alps, is neither as long nor as high.

In "Gliding Notes" for December 6, 1957, a map was given showing the routes of the principal cross-country flights made along waves in the lee of the mountains, and one such flight, of 200 miles by Ralph Court, in North Island was mentioned; he took 4 hr. and reached 25,000 ft., flying a Skylark 3. It now appears that this was an out-and-return flight. Starting from Masterton airfield, and releasing over Greytown, in the lee of the Tararua range, he flew northwards to Waipawa, near Napier, in the lee of the Ruahine range, photographed the turning-point, and returned southwards to Masterton. This was on October 26.

Now comes news that this flight has been surpassed by another North Island pilot, Gordon Hookings, who covered 530 km. (329 miles) in three legs on December 13, in the Skylark 3, using a lee wave created by the same two ranges that Court had used. These ranges, Tararua to the south and Ruahine to the north, lie on the same straight line, but with a 30-mile gap between them. To cross the gap, enough height must be gained in the lee wave from one range to glide across to the other and still be high enough to catch its wave.

Hookings started from Masterton and climbed in thermals till he found himself in wave lift, rather unexpectedly because there were no lenticular clouds there to indicate its presence. He then flew 74 miles northwards, gaining 18,000 ft. for a crossing of the gap, reached the Ruahine range at 11,500 ft., continued to a turning-point at Dannevirke, and soon afterwards was at 21,500 ft. After crossing the gap again, going southwards, he continued on to the southern end of the Tararua range, making the second leg 94 miles long. Then after a northward turn, he climbed to 23,000 ft. for a third crossing of the gap, flew along the Ruahine range to reach its northern extremity at 18,000 ft., and continued northward from there to a landing near Lake Tutira.

The length of this third leg was 161 miles, making 329 miles for the whole journey. Hookings thereby earned a diamond for distance and another for height, and became the first pilot to exceed 500 km. in the British Commonwealth.

A scheme for making a two-legged 500-km. flight in England was tried out by Philip Wills last summer. The first leg was eastwards along the South Downs from Petersfield to Firle; with a northerly wind this could be done by slope-soaring before the thermals started. The second and longest leg was to have been from Firle westwards to Land's End, but the thermals gave out in the middle of Cornwall after Wills had covered 447 km.

Regarding the North Island wave in New Zealand, there seems some reason to expect that the wave in the lee of one range should continue across the gap and join up with the lee wave from the other, especially as most of the gap is higher than the surrounding country, rising to about 2,000 ft. A similar configuration is to be found just westwards of the Cuckmere Valley at the Southdown Gliding Club's former site, but on a very much smaller scale. On the last day of the 1949 Easter camp there, in a west wind, I found a belt of wave lift at 1,000 ft. all along the middle of the valley and continuing half a mile out to sea. The southern end of this belt was in the lee of Seaford Head, 283 ft. high, and the northern end in the lee of still higher ground, but between the two was a gap occupied by flattish ground rising to little more than 100 ft. Yet the lift in the lee of this gap was just as strong as elsewhere.

Once, in a south wind, at the Long Mynd, there was a belt of cloud and wave lift 20 miles long running east and west, with nothing but irregular hills to windward of it, and nothing resembling a long east-west ridge to account for its presence. There seems good reason to suspect that, under certain conditions, a wave once formed tends to spread sideways across the wind direction.

* * *

LONDON GLIDING CLUB has beaten all its previous records with 2,789 hours' flying during 1957. Another club record is 4,607 cross-country miles; this total is accounted for by 78 flights, including flights westwards to Devonshire, northwards to the Humber, and south-eastwards to France. The number of launches, 10,551, is a post-War record only; during 1938, in the days of primary training, mostly by means of short hops, there were 13,173 launches. Last year 15 Silver "C" certificates were completed, and three 300-km. distances flown for the Gold "C," two of which were goal flights and earned a diamond.

No record of club flying at Dunstable was kept until 1936, but in 1932 the total flying was estimated at 250 hr., out of about 300 hr. flown in the whole country. The 1936 figure, covering June to December only, was 535 hr.; thereafter there were 1,095 hr. in 1937 and 1,584 hr. in 1938. In 1946, with only one machine to start with, the total was down to 305 hr., but from 1948 onwards it has been round about 2,000 hr. a year.

* * *

CAMBRIDGE UNIVERSITY GLIDING CLUB has an odd note in its latest newsletter regarding its T-21b two-seater: "Will all current and budding Bluebell drivers (passenger carriers) please note that in future they must fly from the right-hand seat unless and until specifically passed out by an instructor as competent to fly from the left-hand seat."

From this one can only surmise that this regulation has been drawn up by a member from the Cavendish Laboratory, as a result of the latest discovery by atomic physicists that there is no "parity" in the Universe—that is, our Universe is a left-handed one, so to speak, and would therefore be distinguishable from its mirror image.

The club hopes to gather in old members from far and wide for its annual dinner at the Garden House Hotel, Cambridge, on February 15. Later fixtures are camps at the Long Mynd from March 19-April 2, June 7-22 and September 15-29, while there will be three instruction courses in July and August.

Coventry Gliding Club has acquired its first brand-new machine—a Slingsby Prefect. The other six machines in the club fleet were all obtained second-hand.
—A. E. SLATER.

CORRESPONDENCE

Not Good Greek

HAVING read in THE AEROPLANE for January 17 an account of an American project described as a "triphibian," I have sought an explanation of this term in vain. Can you please enlighten me as to its derivation?

Kingston, Surrey. "PURIST."

[We are, of course, aware, as perhaps "Purist" suspects, that the word amphibian is derived from the two Greek words, "amphi"—both and "bios"—life. Consequently, an animal or aeroplane which leads three kinds of existence should rightly be called a "tribian" and not a "triphibian," because the Greek prefix for three or triple is "tri," not "triphi." However, we did not coin this word and it appears to be the makers' designation for their product, which explains how it came to be used.—ED.]

Missile Data Sheets

I AM purchasing THE AEROPLANE specifically to collect your series of GUIDED WEAPONS DATA SHEETS.

The sheets will provide a very useful reference for guided weapons information. However, I would like you to consider printing in a different manner. Would it be possible to print each page (two sides) with weapons of the same section? As it is printed now it is impossible to file the pages as more than one weapon section appears on each of the pages (both sides). For example, page 20, January 3, has an A.-S, an A-U and an S-A. The only filing system to cope with your printing, is date of issue—not very satisfactory.

Bracebridge Heath, Lincoln. J. D. WATSON.

[We are glad to have Mr. Watson's comments on the subject of missile data sheet arrangement by types. While this has its attractions from the point of view of filing the sheets, it can—in a given set—lead to the omission of missiles in other categories which may be of topical interest. That is one of the reasons why our first data sheets have contained a mixture of types. We would welcome more readers' views on this problem.—ED.]

Early Records

HAVING read Mr. John Taylor's letter in your issue of January 3, I referred to my old copies of THE AEROPLANE. Unfortunately I do not possess one covering May, 1913, but I do have an issue for January, 1914. This includes a summary of the important events in the preceding year, month by month. There is no reference to any flight by E. L. Gerrard in May. It mentions an altitude record by Mr. Hawker in a Sopwith biplane on May 31. (Mr. Hawker made many such records that year.)

There is also reference to a flight in a B.E. biplane by a Capt. Longcroft from Farnborough to Montrose in one day—May 21, 1913.

Since there is no reference to the event mentioned by Mr. Taylor could he have got the date wrong? It seems strange that THE AEROPLANE did not record it, when other similar events were shown.

Cambridge. R. BEALES.

Time on Jets

REPLYING to my letter concerning jet fighter hours, Flt. Off. Mattinson has spoken on behalf of Fighter Command. Unfortunately she reveals rather obviously that only one man in the whole of that Command has at present achieved more than 2,000 flying hours on jet fighters.

Full credit to the one individual, but considering that these aircraft have been in use for over 12 years surely many other pilots should have flown the same amount.

There is something alarmingly wrong when pilots are achieving less than 3½ hours weekly over a period of 12 years.

Norfolk. A. M. SIMPSON.

Piling it On

THE aeronautical "Xmas tree" viewed quietly by the fireside through the "clear vision window" of THE AEROPLANE appears to be in the process of a winter pruning session, and unless more than a little skill—and thought—are put into the job, some of the wrong branches will get lopped off and the fruit (very exportable) will fail in yield and quality. There is some dead wood, which has been in existence for years, which can be well disposed of, however—and some of this can be associated with the fearsome array of gadgets galore, which get unleashed and festoon the modern aeroplane. Such things, being somebody's pet babies, get themselves adopted as an alleged improvement. They are embodied, more often than not, smack in the middle of the production line, as a mod. (another name for an afterthought) or could be an open admission of inefficient primary design—or stressing.

Away with this mod. mess. Production could then accelerate, unfettered by the gadgetary game—which methinks needs a better set of rules, anyhow.

Gloucester. L. MORGAN.

No. 8 Sqn. History

MAY I appeal through your columns to ex-members of No. 8 Squadron, R.A.F., for any help that they could give me in writing the Squadron History.

I already have a framework of facts to build on, but I would like to enlarge on these by including more comprehensive details. Any accounts of their experiences from old squadron members would be most welcome; as would historical or interesting photographs.

Officers Mess, Royal Air Force, Khormaksar. B.F.P.O. 69 C. G. RICHARDSON (Flt. Lt.).

Groundabout

Vickers Victory. A few thoughts about the Vickers V.C.10. First, a friend, obviously as ignorant as I am, asks why, following the Vickers 1000 project, is this one numbered 10? Secondly, he suggests that when they get around to naming it they might try the Vickers Victelle or perhaps the Caravictor. I see what he means. My own thought is that with the wing so close to the engines, make it a high wing and you have ready-made blown flaps or laminar flow or something.

✱

In That Order. The V.C.10 has Rolls-Royce engines (I almost added "of course") and I'm reminded of the sales power of that wonderful name and how S.A.S. always advertise their forthcoming "Rolls-Royce powered DC-8s" and similarly with their Caravelles. Probably become the "R.R.8" and "Rolls-Royce Caravelle" before long. But I must be careful. I once drew a Dove, for fun, in a U.S. sales room with a show-card promising "U'll Luv the Duv" and blowed if D.H.'s American agents didn't go and use the phrase in their advertising.

✱

Pass, Friend. In the course of their lawful duty at a U.S.A.F. base in England two Post Office engineers were arrested as intruders during an exercise. British

indignation has been such that when a U.S.A.F. Sabre subsequently landed without permission at London Airport, there was a wild hope that some P.O. engineers might be found to take over airport security duties, if only temporarily.

✱

Piece of Shortcake. Short's publicity people were puzzled about references in some foreign journals to the "Short Scone." Then they recollected phoning a news agency about the S.C.1 and spelling the numeral, just so there would be no mistake.

✱

Vital Statistics. I think we've still time to send some much-needed New Year good will to the P.R.O. who recently distributed a photograph of some *most* important members of his company's board and then discovered the typist's caption error which informed the recipients that the P.R.O. would, if asked, send them "full biological details" of this fine body of men.

by Lorenzo

NOTES AND EVENTS

AEROSURVEY COMPANY.—Derby Aerosurveys, Ltd., has been formed within the Derby Aviation Group and will continue the air-survey activities of the parent company, and the oblique photography formerly done by Photoflight, Ltd., of Elstree, which is now absorbed into the new organization. Chairman of the new firm is Gp. Capt. C. A. B. Wilcock, O.B.E., A.F.C., A.F.R.Ae.S., M.P., and the managing director is Mr. E. W. Phillips, M.B.E. The former managing director of Photoflight, Ltd., Lt.-Col. H. C. Butcher, D.S.O., is the company's technical director, and operations director is Mr. D. F. Ogilvy. The company operates two Austers specially equipped for oblique photography, and two Ansons are available for survey work. The address of the company is 78 Buckingham Gate, London, S.W.1. (Telephone, Abbey 2345), but most of the administration will be handled from Elstree Aerodrome. (Telephone, Elstree 3148 and 3070).

NAVAID SYMPOSIUM.—A convention on Radio Aids to Aeronautical and Marine Navigation is to be held at the Institution of Electrical Engineers in London on March 27 and 28. Details can be obtained from the Institution.

LORAN SALES.—The Edo model 345 airborne LORAN developed by the Edo Corporation of New York is to be distributed and installed in United Kingdom aircraft by the Electronics Division of Murphy Radio, Ltd. This equipment can be fitted in the pilot's instrument panel and has a total weight of 26 lb.

INSTRUMENT SHOW.—During the last week in March the fourth International Instrument Show is to be held at Caxton Hall, London. Sixty companies representing 10 countries will show their products. Admission will be by ticket—obtainable from the sponsors, B. and K. Laboratories, Ltd., 57 Union Street, London, S.E.1.

CELLON TRIBUTE.—An original painting by Roy Nockolds, of five aerobatic Hunters of No. 111 Squadron, R.A.F., has been presented by Cellon, Ltd., to Sqn. Ldr. R. Topp, the Squadron Commander. A reproduction of this painting was used by the company for its advertisement on the front cover of THE AEROPLANE last September and a coloured transparency of it formed the central theme of its S.B.A.C. stand.

AIRCRAFT EQUIPMENT.—Ultra Electric, Ltd., has reorganized its special products division which manufactures aircraft radar and electronic equipment. Under the control of Mr. A. V. Edwards, general manager, the division now consists of three departments: commercial (Mr. A. M. Pollock); engineering (Mr. W. H. Medcalf) and production (Mr. R. M. W. Grant).

ON VIEW.—An exhibition of British and Continental sheet-metal working machinery is currently being held in the new showrooms of the Press and Shear Machinery Co., Ltd., at 172-178 Victoria Road, Acton, London, W.3. A number of the machines on view are ready for immediate demonstration under power.

ETHIOPIAN SURVEY. — Hunting Aerosurveys, Ltd., has recently started work on an extension to an aerial survey contract awarded by the Imperial Highway Authority of Ethiopia at the beginning of 1957. The extension calls for medium-scale photography of approximately 65,000 sq. miles and when completed will make a total of 73,000 sq. miles of country photographed. A Dakota and two Lodestars are used for the survey.

IN MINIATURE.—Realistic 1/72nd scale models of some of the more interesting historical and contemporary aircraft are produced by Airfix Products, Ltd. The models, which are of plastic, are sold in kit form for assembly and cost 2s. each. They include, as shown here, the Spitfire, Lysander, Gladiator, Tiger Moth, Junkers Ju 87, Fokker Triplane and Bristol Fighter.

Aviation Calendar

January 28.—R.Ae.S. Graduates' and Students' Section lecture, "Developments in Glider Design," by K. G. Wilkinson, in the Library, 4 Hamilton Place, **London**, W.1, at 19.30 hrs.

January 28.—R.Ae.S. Bristol Branch lecture, "Aircraft Flight Systems," by Capt. A. M. A. Majendie, in the conference room, Bristol Aircraft, Ltd., Filton House, **Bristol**, at 18.00 hrs.

January 29.—Kronfeld Club, programme of colour stills, "Clouds," by Dr. R. S. Scorer, at 74 Eccleston Sq., **London**, S.W.1, at 20.00 hrs.

January 29.—R.Ae.S., Preston Branch lecture, "Ramjets," by Dr. R. R. Jamison (Asst. Chief Engineer, Ramjets, Bristol Aero-Engines, Ltd.), at the Queen's Hotel, **Lytham**, Lancs, at 19.30 hrs.

January 29.—R.Ae.S. Weybridge Branch, film show at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge**, at 18.00 hrs.

January 29. — R.Ae.S. Southampton Branch lecture, "Flight Testing Procedures at Supersonic Speeds," by Wg. Cdr. R. P. Beamont, D.S.O., O.B.E., D.F.C., A.R.Ae.S., in the Inst. of Education, **University of Southampton**, at 19.00 hrs.

February 1. — British Interplanetary Society lecture, "Meteoric Hazards to Space Flight," by Dr. N. H. Langton, M.Sc., A.Inst.P., in the Tudor Room, Caxton Hall, **London**, S.W.1, at 18.00 hrs.

February 4. — R.Ae.S. Luton Branch lecture, "Development of the Armstrong Siddeley Viper," by W. H. Lindsey, M.A., F.R.Ae.S., in the Napier senior staff canteen, **Luton Airport**, at 18.15 hrs.

February 4.—Inst. of Civil Engineers lecture, "The Use of Aerial Photography by Railways," by N. E. V. Viner-Brady and H. M. Pearson, at Gt. George St., **London**, S.W.1, at 17.30 hrs.

February 5.—Kronfeld Club lecture, "The Oxygen Story," by G. Melvill-Jones (R.A.F. Inst. of Aviation Medicine), at 74 Eccleston Sq., **London**, S.W.1, at 20.00 hrs.

February 5.—R.Ae.S. London Airport Branch lecture, "Noise," by Professor E. J. Richards, M.A., B.Sc., F.R.Ae.S. (Southampton University), at **London Airport**, at 18.00 hrs.

February 6.—Inst. of Prod. Engineers, 1957 Viscount Nuffield Paper, "Technical Education for Production Engineers," by the Rt. Hon. The Lord Hives, C.H., M.B.E., D.Sc., LL.D., in the Large Lecture Theatre, Engineering Faculty, **University of Bristol**, at 18.30 hrs.

February 6.—Kronfeld Club film show, "Twelve O'clock High," at 74 Eccleston Sq., **London**, S.W.1, at 20.00 hrs.

NEW PREMISES.—S. N. Bridges and Co., Ltd., has acquired new premises at 15 Quay Street, Manchester, 3, where there are both service and sales departments. Telephone numbers for the departments are Deansgate 4928 and 4929 respectively.

Company Notices

NEW COMPANY

Popes Aircraft Components, Ltd. (596,323)—Private co. Reg. Jan. 1. Cap. £100 in £1 sh. Objects: To carry on the business of aeronautical engineers, etc. Directors: Evangeline Constable, 35 Harlows St., Broadstairs; Elizabeth Hartley, 4 Westfield Av., Watford; Lillian Holton, 38 Brampton Rd., Hillingdon; Clifford J. Saunders. Reg. off.: 4 Westfield Av., Watford.

CHANGES OF NAME

Palmer Tyre, Ltd. (43,560), Herga House, Vincent Square, London, S.W.1. Name changed to Palmer Aero Products, Ltd., on December 2, 1957.

Hunting Percival Aircraft, Ltd. (317,324), The Airport, Luton, Beds. Name changed to Hunting Aircraft, Ltd., on December 5, 1957.

New Patents

APPLICATIONS ACCEPTED

791,423.—Helio Aircraft Corporation.—"High-lift airplane with all-moving tail plane."—July 11, 1955 (July 30, 1954).

791,623.—British Messier, Ltd.—"Power-operated aircraft controls."—Nov. 30, 1955 (Dec. 16, 1954).

791,563.—Vaghi, J.—"Structures for use as an airplane wing, a propeller blade, a blower or fan blade."—Oct. 28, 1955 (May 2, 1955).

791,474.—Hunting Percival Aircraft, Ltd.—"Helicopter rotor."—April 10, 1956 (Jan. 11, 1955).

Applications open to public inspection on March 5, 1958; opposition period expires on June 5, 1958.

Personal Notices

BIRTHS

Bartlett.—On December 22, at Aldershot, to June, wife of Sqn. Ldr. C. Bartlett—a son.

Cox.—On January 7, at Cheltenham, to Susan (*née* O'Keeffe), wife of Sqn. Ldr. A. H. Cox, M.B., B.S.—a son.

Dyer.—On January 10, at Tidworth, to Trudy (*née* Lohman), wife of Sqn. Ldr. M. Dyer—a son.

Foulks.—On January 9, at Cambridge, to Bettine (*née* Stephens), wife of Flt. Lt. R. A. Foulks—a daughter.

Harris.—On January 3, at Pembury Hospital, to Nancy, wife of Flt. Lt. E. N. Harris—a son.

Langley.—On December 31, at Harrogate, to Mary (*née* Kenny), wife of Flt. Lt. P. J. Langley—a son.

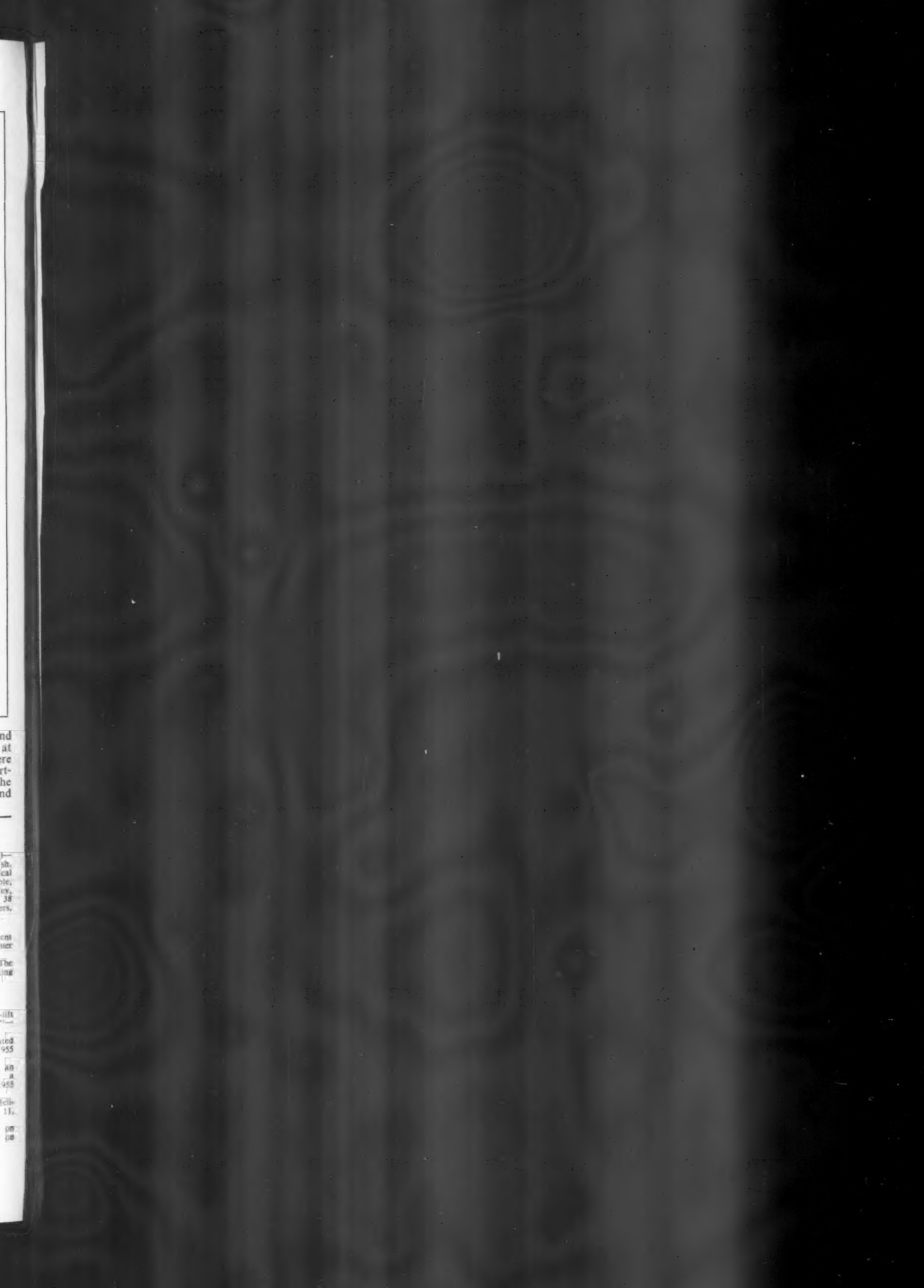
Mackay.—On December 28, at Ely, to Anne (*née* Farr), wife of Wg. Cdr. S. Mackay—a son.

Norris.—On January 7, at Wegberg, to Juliet (*née* Stanley), wife of Sqn. Ldr. P. Norris, M.B., Ch.B.—a daughter.

Penley-Martin.—On December 29, at Ely, to Gilian, wife of Flt. Lt. J. R. Penley-Martin—a daughter.

Smith.—On December 22, at Bahrain, to Patricia, wife of Sqn. Ldr. L. G. (Peter) Smith, D.F.C., D.F.M.—a daughter.

Wood.—On January 4, at Louth, to Petronella (*née* de Wilde), wife of Flt. Lt. E. T. Wood—a son.

MARRIAGE

Cole—Lawson.—On January 2, at Queensferry Parish Church, Sqn. Ldr. John Cole to Margaret Lawson.